AGRICULTURAL CHEMICALS

Serving the field of...

AGRICULTURAL INSECTICIDES
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•
DAIRY FARM CHEMICALS
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WEED CONTROL CHEMICALS
•
SOIL TREATING MATERIALS
•
SEED TREATING CHEMICALS
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RODENTICIDES
•
FERTILIZERS

Dec. 1947

Vol. II No. 12

Even a big-league pitcher can't be sure of hitting a bug with a baseball—*which is another way of saying that micro-fine particle size is a vital factor in the effectiveness of insecticide dusts . . .*

ATTENTION, DUST MIXERS:

ORTHO now offers you micro-fine dust concentrates for your manufacture of high-quality insecticide dusts

ORTHO'S micro-fine concentrates are manufactured with special attention to fineness of particle size and uniformity, using special diluents to give proper adhesiveness to plant surfaces and dispersibility in the finished dust. They are made up for convenient usage in your plant.

Before ordering dusts it will pay you to investigate the many decided advantages of using ORTHO micro-concentrates in your dust formulation.

We can supply you now with

GAMTOX Micro-Concentrate No. 100
(contains 10% Gamma Isomer of Benzene Hexachloride)

PERSISTO Micro-Concentrate
(contains 50% DDT)

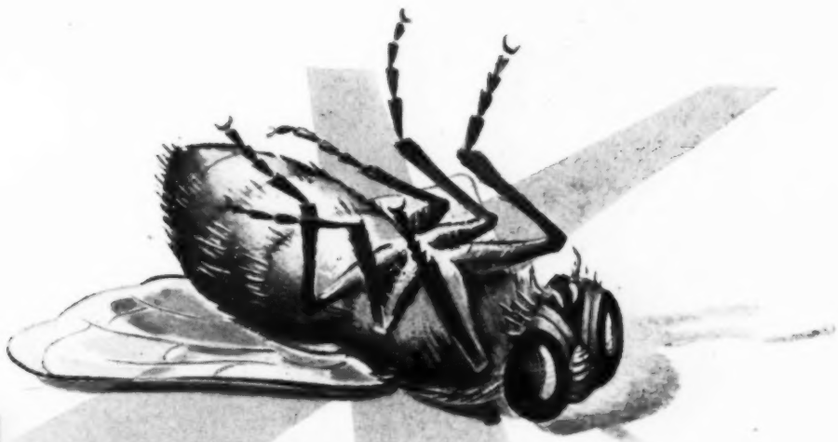
Plus other micro-concentrates

Write or wire for prices, packings and samples from the following ORTHO offices: California Spray-Chemical Corp., Elizabeth, New Jersey; Orlando, Florida; Dallas, Texas; Kansas City, Missouri; Portland, Oregon; and Whittier and Richmond, California.

FREE "ORTHO" SERVICE! Through your ORTHO Fieldman you can get full information on formulation, fillers, uses, technical improvements on mixing, milling and testing procedures. Also facts on test runs for special problems and formulations.

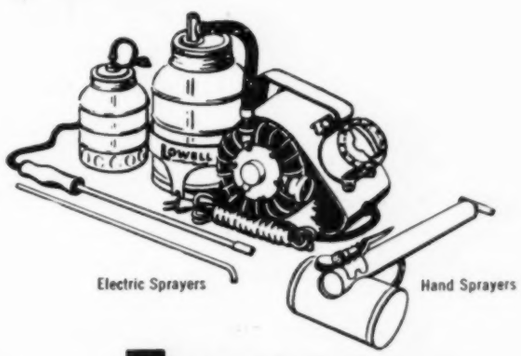
ORTHO
SCIENTIFIC PEST CONTROL

LOOK TO LOWELL



to "boost" Insecticide Sales

Give your insecticide . . . liquid or powder the merchandising "push" that outstrips competition. Double its saleability with Lowell Sprayers and Dusters—the name your customers associate with quality . . . the products that ensure results. Don't be "insecticide-wise and sprayer-foolish." Write Lowell now for information on how Lowell Sprayers and Dusters can boost sales for you!



Electric Sprayers Hand Sprayers

"I get more repeat sales on insecticides when I sell Lowell Sprayers and Dusters. Lowell helps me to have satisfied customers."

A Lowell Dealer
(name on request)

LOWELL
Manufacturing Co.
DEPT. 62 , 589 EAST ILLINOIS, CHICAGO 11, ILL.

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L. M. Co.

WORLD'S LARGEST MANUFACTURER OF SPRAYERS AND DUSTERS EXCLUSIVELY

GENERAL CHEMICAL

Organics and Inorganics

With Sound Values ...From Experience✓

✓ General Chemical "Orchard Brand" products are backed by sound research—quality control in production—and nearly 50 years' experience in the manufacture of insecticides and fungicides, combined with close practical association with growers in their uses.

Insecticides and Fungicides for the Fruit Grower

DDT including concentrates and DDT 50% Micro-Fine Spray Powder

Benzene Hexachloride including concentrates and BHC 6% Gamma Isomer Micro-Fine Spray Powder

Lead Arsenate, Astringent & Standard

Nicotine Sulfate

AATP Miticides

Sulfurs, Micro-Fine

Organic Scab Sprays

Copper Sprays & Dusts

Pre-Harvest Sprays and Dusts

Specialized Agricultural Chemicals

Be sure **when buying your spray requirements. Specify only genuine "Orchard Brand" products bearing these trade marks:**

GENITOX® • GENICIDE® • GENIDUST®
GENICOP® • GENISUL • GENITOL®
FILMFAST® • ASTRINGENT "LEAD"
DRITOMIC® SULFUR • SPRAYCOP®
STAFAST® • MICRO-DRITOMIC® SULFUR

FOR FULL INFORMATION on these General Chemical "Orchard Brand" products or special formulations, write or phone nearest office.

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ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET **NEW YORK 6, N. Y.**

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver Detroit • Houston • Kansas City • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Portland (Ore.) • Providence • San Francisco Seattle • St. Louis • Wenatchee • Yakima (Wash.)

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AGRICULTURAL CHEMICALS

A Monthly Magazine For the Trade

THIS MONTH'S COVER

Use of toxic insecticidal materials such as hexaethyltetraphosphate in greenhouses requires protection for the person applying the material. See article on use of aerosols in greenhouses, page 28.

DECEMBER 1947
VOL. II No. 12

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Subscription Rates: *One year* $3.00, *two years* $5.00. *Outside U. S. one year,* $4.00. *Published monthly on the 15th by Industry Publications, Inc. Office of Publication, 123 Market Place, Baltimore 2, Md. Advertising and editorial office, 254 W. 31st St., New York, 1, N. Y. Advertising rates made known on application. Closing date for copy—25th of the month previous to date of issue.*

Entered as Second Class Matter at the Post Office at Baltimore, Md., under the Act of March 3rd, 1879.

LIVESTOCK

To help you meet AN EVER-GROWING MARKET—

Baker's DDT

CROPS

FORESTS

PUBLIC PLACES

Use of DDT spreads every year. More and more people depend on DDT for controlling certain insect pests of livestock, crops, gardens, homes, orchards, forests, and public places.

Farmers find spraying cattle with DDT during fly season often increases beef gains as much as ½ to 1 pound per day . . . increases milk production as much as 20 per cent. Spraying potatoes increases yields up to 25 per cent, sometimes more.

Public officials and owners of recreational facilities spray parks, ball fields, grandstands, resorts, and other public places with DDT—to help promote public health, as well as make the facilities more enjoyable.

Foresters recently sprayed 387,000 acres of forest land in the Northwest with DDT to save an estimated $60,000,000 worth of timber from Douglas fir tussock moths. In the Northeast forests DDT is being used to control the gypsy moth.

Increased use of DDT means an expanding market to those who formulate insecticides. Get set now for next year's sales.

Baker's DDT is a granular product approaching a white color, with a minimum setting point of 89° C. It is uniform in color, makes a clear solution, is free flowing and uniform in particle size. This enables the manufacturer to perfect his mix before grinding.

Baker's DDT comes in 25, 50, 100 and 200-lb. containers. We invite you to write for prices and tell us your requirements. Address *Agricultural Chemical Division,* J. T. Baker Chemical Co., Phillipsburg, N. J.

Baker's Chemicals

C. P. ANALYZED • FINE • INDUSTRIAL

IN AGRICULTURAL INSECTICIDES

the Big Profit is in "Specialties"

The foundation of the insecticide business will always rest on the basic mixtures which do an efficient, though general job. But the cream—the gravy—comes from selling "specialties"—those formulations which ingredient supplier and manufacturer devise cooperatively to do a *specific* job on a *particular* insect problem—or to overcome unique local conditions.

Aggressive local manufacturers all over the country have recognized this fact and proved it true. They haven't eliminated their basic mixtures—they continue to rely upon them and MGK for the unwavering high quality which makes those mixtures superior and competitive in cost.

But they also offer their customers special formulations, created by the combination of *their* understanding of unusual local needs and *our* research and experience. This policy has increased their insecticide profits, added to their reputation for service and greatly expanded their local market.

Now we offer this to you—highest quality basic ingredients AND cooperation in developing big-profit, specialty formulations. Wire or write McLaughlin Gormley King Company, Minneapolis, Minn.

Better Basic And "Specialty" Insecticides

McLAUGHLIN GORMLEY KING CO.

Makers of Insecticides Founded 1902

Minneapolis, Minnesota

VETERINARY SUPPLY HOUSES

Whether under actual use or subjected to the most rigid scientific tests, Baird & McGuire's CRESTALL FLUID comes through with flying colors.

Known for its thoroughness, high quality and uniformity, this disinfectant fills a very important need of the veterinarian, the veterinary hospital or for general farm use.

Available under private brand labels or in bulk quantities, veterinary supply houses are invited to write for prices, full details and samples.

Baird's

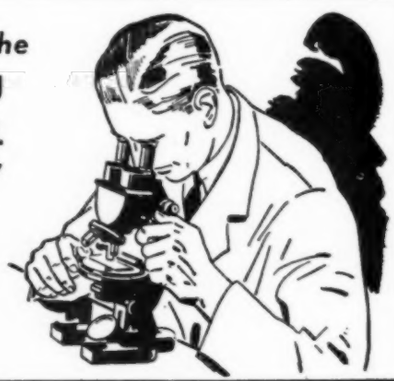
Please Address Your Inquiries To Our AGRICULTURAL DIVISION

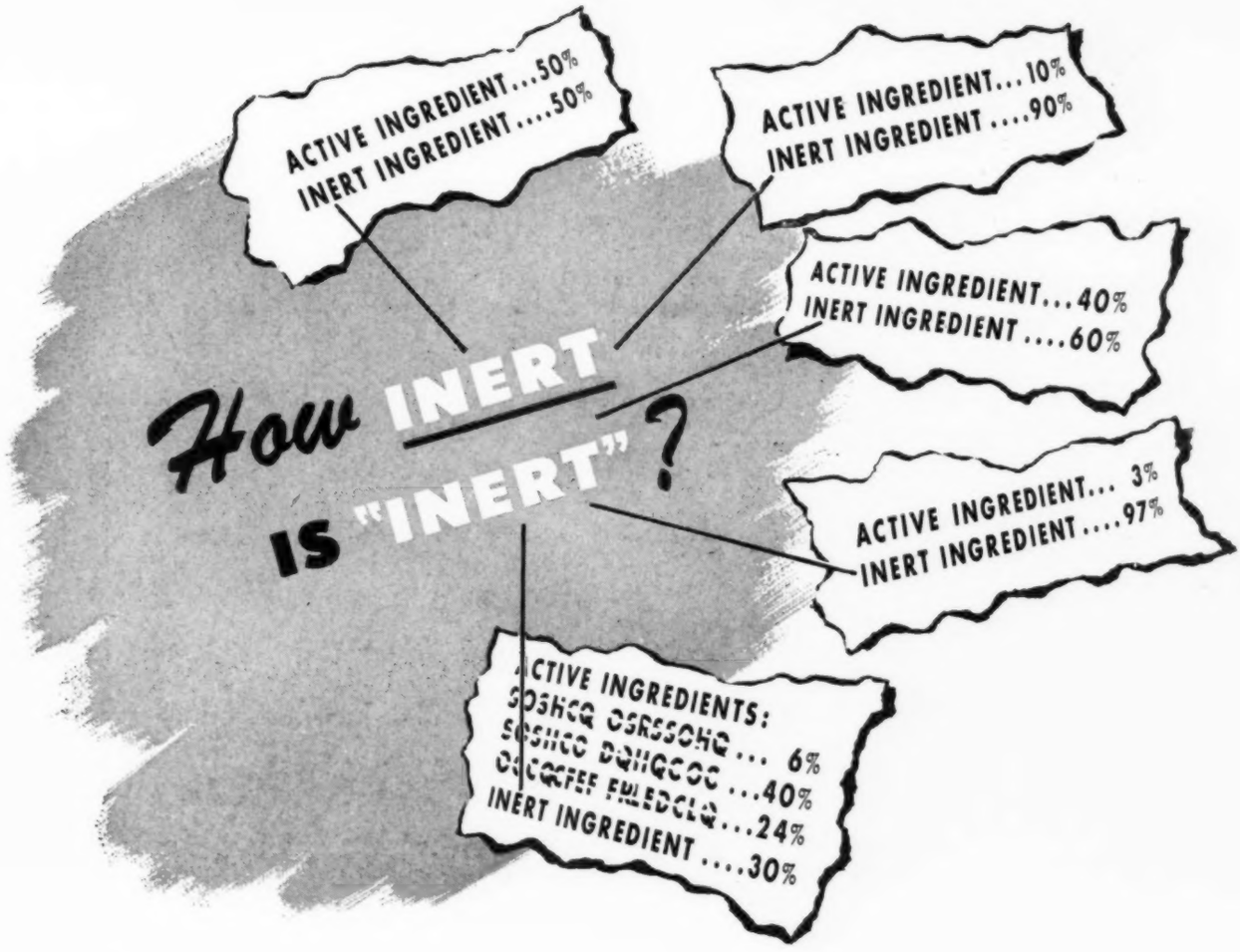
BAIRD & McGUIRE, Inc., Holbrook, Mass.

CRESTALL FLUID

Approved By The
U. S. BUREAU OF ANIMAL INDUSTRY

For official disinfection of cattle cars, trucks, boats or other premises harboring cattle or livestock.





Of "inert", Mr. Webster says: "Incapable of producing an effect." Obviously he wasn't thinking of dust concentrate or finished dust formulas in which Attaclay is the "inert" ingredient. People who investigate, make or use dusts are becoming more and more aware of the vital part the *right* carrier and diluent can play. And for many in the trade—in more and more formulas—Attaclay is capably producing the good effects most wanted.

Right now we make no claim that Attaclay alone is biologically active. But, in many cases, Attaclay has a favorable effect on the activity of the toxicant. And certainly it eases steps in the making and putting on of dusts. So, let's compose our own carrier and diluent glossary:

ADSORPTIVITY—Uniformly accepts up to 90% of chlordane—50% DDT or benzene hexachloride—2-5% additive oils, yet retains its dry, lump-free state. This means greater killing power per pound of finished product.

FLOWABILITY—Attaclay's freedom from caking and lumping insures trouble-free flow through processing and dusting equipment. This means less down-time for maker and user.

HARDNESS—Does not induce abnormal wear on mixing machines or dusting rigs. This means cheaper maintenance.

DUSTABILITY—Excellent characteristics as regards dispersion, even coverage, tenacity. This means cheaper pest control.

WETTABILITY—Attaclay has inherent wetting action on "hard-to-wet" toxicants. This means formulation savings.

SUSPENDABILITY—Within the required range. Readily modified to meet specific formula needs. This means better performance.

COMPATIBILITY—Attaclay's high degree of chemical compatibility is well-established. This means flexibility—with safety.

These features all add up to one simple truth—it will pay *you* to test Attaclay. Write for a generous sample today.

ATTAPULGUS CLAY COMPANY

Dept. P, 210 West Washington Square, Philadelphia 5, Penna.

MERCK IS SERVING THE INSECTICIDE INDUSTRY AS A BASIC AND PRIME SOURCE OF SUPPLY FOR DDT

An aerial view of the Main Plant of Merck & Co., Inc. at Rahway, N. J.

Because of greatly expanded production and sufficient raw materials, we now are in a position to serve an increasing number of manufacturers of DDT insecticides.

The product we offer is—

DDT

TECHNICAL

(dichloro-diphenyl-trichloroethane)

Setting point 89° C. Minimum
For Manufacturing Purposes Only

Write us for prices and let us know your requirements. Please address your inquiry to the Insecticide Products Department, Merck & Co., Inc., Rahway, N. J.

DDT TECHNICAL

For the Manufacture of Agricultural, Livestock, Horticultural, and Household Insecticides

MERCK & CO., Inc. RAHWAY, N. J.

Manufacturing Chemists

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MERCK MERCK

From the welter of claim and counter claim, Chlordane stands out as:

1. **Most *effective* against a wide variety of resistant insects: Cotton Pests, Grasshoppers, Soil Insects, Truck Crop Pests and Livestock Parasites.**
2. ***Easy and simple* to formulate in emulsions, oil solutions, wettable powders and dusts; Chlordane is completely soluble in all commonly used solvents.**
3. **Most *versatile;* outstanding in agricultural, household, industrial and veterinary formulations.**
4. **Most *agreeable* to use, practically odorless, non-staining, non-crystalline. Means satisfied customers and steady repeat business.**
5. **The toxicant with *unsurpassed profit* possibilities for formulator—dealer—retailer.**

Chlordane (Octa-Klor brand) is manufactured in agricultural and refined grades, both of which are 100 per cent active insecticidally. Informative bulletins comprehensively covering specific problems may be had by sending the coupon.

JULIUS HYMAN & COMPANY
Denver, Colorado

Gentlemen: Please send us the following:

☐ Ant Bulletin ☐ Grasshopper Bulletin ☐ Live Stock Bulletin ☐ Truck Crop Bulletin

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Announces The Services Of Its

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For The Biological Evaluation Of Agricultural And Household Insecticides

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- **EVALUATION OF PROPRIETARY HOUSEHOLD INSECTICIDAL MATERIALS**
- **DETERMINATION OF POTENCY OF PROPRIETARY AGRICULTURAL DUST AND SPRAY MATERIALS**
- **SCREENING OF UNKNOWN COMPOUNDS**
- **INSECTS FOR TESTING AND SCREENING WORK**
- **MISCELLANEOUS INSECTICIDE SERVICES**

In addition to this insecticidal work the Foundation offers a variety of other laboratory services. We invite your inquiries.

WISCONSIN ALUMNI RESEARCH FOUNDATION

P. O. BOX 2059 **MADISON, WISCONSIN**

PYREXCEL 20

IT'S *SYNERGIZED*—

Higher in efficiency

Pyrexcel, a synergized pyrethrum extract, an achievement of the S. B. Penick & Company Research Laboratories, is a product of high efficiency with equal or greater kill than many high priced insecticides. Pyrexcel sells at lower cost.

Lower in cost

• For low pressure aerosol, n-propyl isome is a perfect pyrethrum synergist.

Have you heard pyrethrin products are now lower priced?

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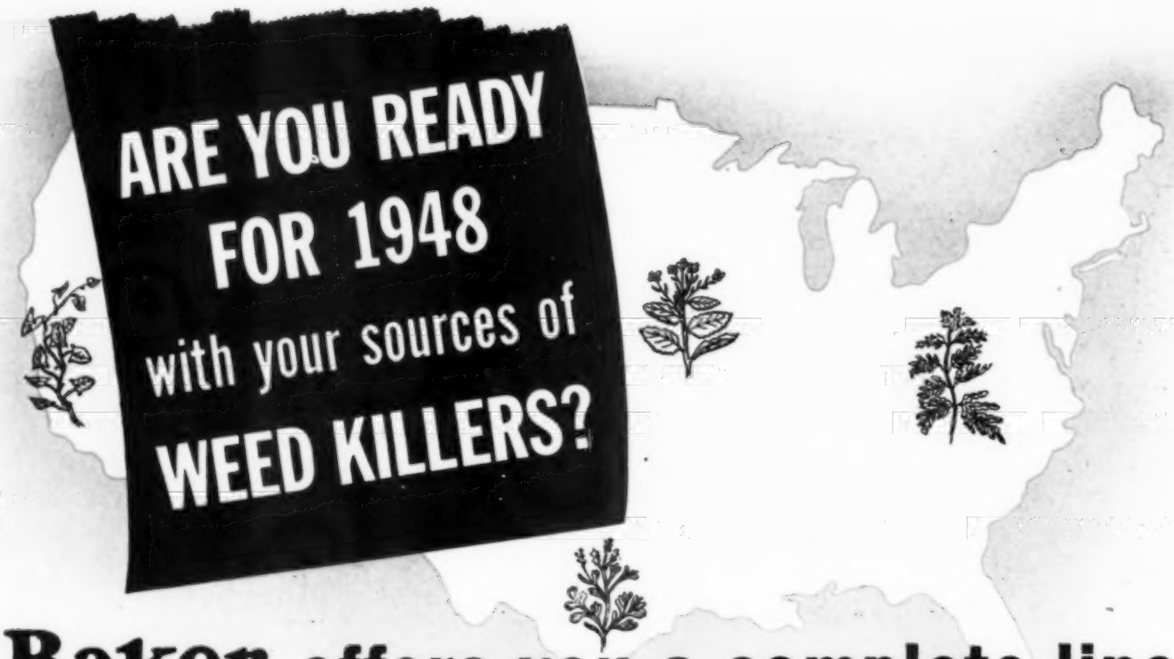


Baker offers you a complete line of "custom-made" 2,4-D Formulations

It's not too early to make plans for next year's weed killer sales. Be sure to line up a good and reliable source of 2,4-D now.

Baker offers you *a number* of 2,4-D Formulations—"custom-made" to meet almost any weed situation, and to make selective weed-killing more effective and efficient. There is *no one* weed killer applicable for all types of weeds under all conditions.

Whatever your customer's weed problem, Baker most likely has a special 2,4-D Formulation that just fits the job—whether it's weeds in pastures, grains, cut-over land, fence rows, rights-of-way—application by airplane, fog sprayer, or other special equipment. You likewise have a choice of powder, or liquid concentrate that will yield either a clear solution or a creamy, stable emulsion.

Baker is an old and respected name in the chemical world. For nearly a half century Baker has manufactured chemicals of highest quality and dependability.

The J. T. Baker Chemical Co. has devoted a great deal of time and effort to research, covering the varied problems of killing weeds in different sections of the country.

Now Baker brings you all its rich background of skill and experience, to help solve the particular weed problems of your customers . . . and your packaging and distribution problems!

An extensive localized advertising program will carry the name Baker and what it means in weed killers to your customers.

For best results—satisfied customers—repeat orders—supply your dealers with Baker's 2,4-D Formulations *specifically adapted to the job.* Investigate today.

Write for FREE BULLETINS!

Learn which specific Baker 2,4-D Formulation to use for your special weed problem. Our new free bulletins tell when, where and why to use each—how it is "custom made" for your job. We will also send other valuable, authoritative data on 2,4-D. Write for this free material today! Address *Agricultural Chemical Division,* J. T. Baker Chemical Co., 66 S. Main Street, Phillipsburg, N. J.

FRANCHISES OPEN—
under Baker label, or your own!

Many sales organizations that market weed killers are turning to Baker's "know-how" for up-to-the-minute 2,4-D formulations. If you are interested in distributing weed killers "custom-made" for your local weed problems, write and tell us your requirements. We are in a position to supply you these products under the Baker label—or your own private brand name. Get the details today! Address the *Agricultural Chemical Division,* J. T. Baker Chemical Co., 66 South Main Street, Phillipsburg, N. J.

Baker's Agricultural Chemicals

DOUBLE CHECKED ✓ from RESEARCH to INDUSTRY

SHARSOL

FOR SOLUBILIZING 2,4-D

SHARSOL 221, a mixture of monoethylamine and triethylamine, makes possible the preparation of 2,4-D solutions of 40% strength. This solubilizing agent is economical to use and is readily available in drums or tank cars.

SHARSOL 193, triethylamine, appears to be an outstanding solubilizer for 2,4-D where the following characteristics are desired:

1) Approximately 60% 2,4-D (even below 32°F.)
2) Low freezing point (no anti-freeze agents needed)
3) Relatively low viscosity

When Sharsol 193 is used, the heat of reaction is such that steam need not be used in preparing the solution. Sharsol 193 is available in drums or tank cars.

Samples and further information are available

SHARPLES TRADE MARK CHEMICALS

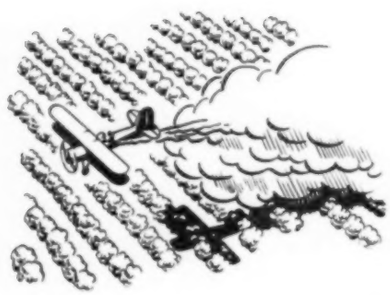
SHARPLES CHEMICALS INC.

PHILADELPHIA CHICAGO NEW YORK

D&O
ESTABLISHED 1798

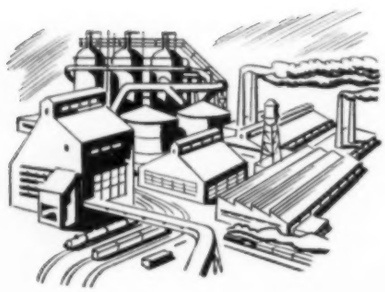
Insecticides to be marketed by...

U.S.I.



On January 1, 1948 the Insecticide Division of Dodge & Olcott, Inc., will be transferred to U.S. Industrial Chemicals, Inc., and will be operated as an integral part of the U.S.I. organization. Sales and invoicing of the products of the Insecticide Division after January 1st will be handled by the U.S.I. sales force and branch offices. Otherwise no changes of personnel or policy are involved.

D&O takes pride in its major achievements which include the production of Purified Pyrethrum extract, the development of a new class of synthetic organic insecticides, and the Pyrenones* based on them. Other developments of equal or greater importance are *only now* ready for introduction.



U.S.I. is in a particularly favorable position to extend the progress in insecticides made by D&O and to make the results rapidly available to the industry. With its many years of experience in producing a diverse line of chemicals closely allied to the insecticide field . . . its strategically-located, nationwide distribution facilities . . . and its highly-trained technical personnel, U.S.I. will offer valuable service.

DODGE & OLCOTT, Inc.

Insecticide Division: 60 East 42nd St., New York 17, N. Y.

*Reg. Trade Mark

now available . . . NIFOS-T

(Monsanto's Tetraethyl Pyrophosphate, Technical)

Formulators of insecticides will be particularly interested in this announcement concerning Monsanto's Nifos-T — *containing approximately 40% tetraethyl pyrophosphate.*

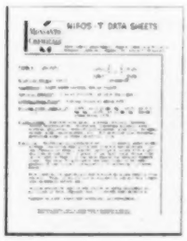
Nifos-T is now available in commercial quantities—at a price that will allow lower cost control of insects and mites.

Bioassays have shown that Nifos-T possesses 3 times the biological activity of hexaethyl tetraphosphate, formerly sold as Nifos.

Inquiries are invited concerning prices and available technical information. Write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Send for Monsanto Technical Data

Included in these preliminary Technical Data Sheets are chemical and physical properties, data on solubilities, stability, uses, compatibilities, concentrations and graphs of hydrolysis vs. time . . . To secure your copy, merely mail the coupon.


NIFOS-T DATA SHEETS

MONSANTO CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY AC-12
Organic Chemicals Division
1700 South Second Street, St. Louis 4, Missouri
Please send Technical Data on Nifos-T.
Name.....
Firm.....
Address.....
City..... State.....

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when it comes to agricultural insecticides

These POWCO CONCENTRATES CAN'T BE BEAT!

DDT

Technical grade. 25% Water Miscible Spray Concentrate. 50% Dust Concentrate. 50% Wettable Powder Concentrate.

HETP

Hexaethyl Tetraphosphate—outstanding new insecticide concentrate for control of Red Spider and aphids.

STIMTOX

Low-cost fortified Pyrethrum powder. Easy-to-use. Stable.

BHC

Benzene Hexachloride—controls cotton insects, aphids, soil-infesting larvae, Japanese beetles, grasshoppers and many others.

SABADILLA

50% dust concentrate of activated sabadilla seed. Used for agricultural dusts and cattle louse powders.

ROTENONE

Standardized for your protection. Time-tested standby for both agricultural and home gardening use.

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THE EDITOR COMMENTS

ONE of the most sensible suggestions yet heard regarding the fertilizer situation, recently came from the "Harriman Committee," composed of 19 private citizens with the Secretary of Commerce as chairman. The committee recommended that the synthetic ammonia plants now owned by the Government be put into full production and that facilities be constructed at these plants to permit production of finished fertilizer-grade nitrogenous materials in integrated operations. It also recommended that these now unused Government-owned plants be sold or leased to private interests with provisions to assure continued production and availabilty of fertilizer materials so long as the need continues.

How great is the need for fertilizer materials at home and abroad? Will the demand for nitrogen continue once the 16 "have not" nations of the Marshall Plan get on their feet again? Why does not the U. S. quickly rehabilitate fertilizer plants in these countries so that they can become partially self sufficient, at least? These questions and others continue to puzzle thoughtful persons who are interested generally in the welfare of the world's people, and particularly in the future of the American fertilizer industry.

The fact is bluntly, the whole world finds itself woefully short of nitrogenous fertilizer materials. Although the U. S. is both the world's largest producer and the largest importer of nitrogen, the tremendously increased domestic consumption plus the unprecedented export demand has practically voided this relative advantage. This country now uses more than twice as much nitrogenous fertilizer in a year as it used before the war,. . . . more than any other nation.

Estimated production of commerical nitrogen for fertilizer this year is 690,000 tons, compared with 665,000 tons last year. The highest wartime production of fertilizer nitrogen was 417,000 tons in 1945; and the prewar average production in the four years of 1934—1938 was a relatively small 166,000 tons. The increase of commercial production this year over last will be substantially in the form of nitrogen solutions, according to the U. S. Dept. of Agriculture.

World requirements for nitrogen show clearly the necessity for dependence at this time upon American production to supply the need. According to the best estimates, there will be a world shortage of at least a million tons of nitrogen. European nations are unable to do much about it right now because of lack of coal, and delays in repairing war-damaged plants. Germany, as well as Japan, is in a bad way in this respect.

That the American fertilizer industry will come through with a record production is not doubted in the least. Our hope is that strikes will not hinder this industry or any of the others upon which it depends for vital raw materials. Such an event could quickly create a critical situation in the food program for 1948.

IN 1948, the market for agricultural chemicals bids fair to show certain changes in the type of demand which some manufacturers, mixers and dealers may not foresee at this time. If, as part of the national program to increase the production of foodstuffs next year, the plans of the U. S. Department of Agriculture and the AIFA for twenty million home gardens actually come about, the requirements of the country in *small-packaged* fertilizers, insecticides, fungicides, and allied chemical specialties are likely to increase sharply. That manufacturers and dealers alike should be ready to meet such demand would seem to be indicated by current developments.

If the campaign to sell the idea for twenty million home vegetable gardens in urban and suburban areas attains even partial success, the increased demand for small-packaged agricultural chemical products will swamp available supplies normally channeled to this market. If the larger demand develops, — and there seem to be strong reasons to believe that it will, — the products

to meet it should be ready. Although it is in reality rather late to change complete sales plans for 1948, which in most cases of course have already been made, some consideration might even yet be given to the potentialities of this expected small-package demand for the coming season. That certain manufacturers and dealers are already setting their sights on this possible market expansion, we have been told. Those who have not as yet given it serious thought might well consider doing so. Time is already relatively short.

ER. Eastman, commemorating recently his 25 years as editor of *American Agriculturist*, century-old American farm journal, called for expressions of opinion on the agricultural outlook of the nation by a number of leaders in industry and science. Their comments insofar as they apply to the chemical products for agriculture are both interesting and significant. Said Clifton A. Woodrum: "The fertilizer industry has pioneered in the tremendous advances of the past 25 years, having increased production from 6,000 000 tons to more than 16,000,000 tons, and at the same time vastly improving its product. While the increases in production have been nothing short of phenomenal, they are dwarfed in comparison with the far-reaching advancements in the field of new plant food processes and developments by private industry during the past quarter century."

"Fertilizers and farming have both come a long way during the (past) 25 years . . . fertilizer use has more than doubled in volume . . . . fertilizers have improved in quality and plant nutrient content . . . inorganic materials have largely replaced natural organics in commerical fertilizers . . . . fertilizer costs to farmer-users too have been lowered and fertilizers are now just about the least costly farm supply item in this period of higher levels for many things." This was the essence of the comments by Maurice H. Lockwood.

Significant also was the statement of Lea S. Hitchner when he said that America has seen "the mechanical age arrive and it is now seeing and welcoming the chemical age in agriculture . . . Our greatest educational opportunity is still ahead. It consists of making not only full use of all the old and new chemicals, but of extending the production of foods and fibres by extending the use of pesticides in the many new fields where chemical agriculture has not been attempted. Present world food conditions make more important than ever before better pest control, which can only be accomplished through broader education."

Whether we realize it offhand or not, these comments of three of our outstanding authorities expressed on the occasion of Mr. Eastman's 25th anniversary indicate that we are in the midst of what is in effect a chemical revolution in agriculture. For fifty years, we have seen developments of the mechanical age in agriculture; we have now entered the chemical age.

THERE seems to be considerable merit in the suggestion, which we have heard recently from a number of quarters, that the entomological and phytopathological societies try to make plans another year for a joint meeting. There are obviously many persons with interests in both groups, who as matters stand now, have to choose between attending one meeting or the other. A joint meeting would solve this problem and would also allow the two organizations to act efficiently on matters of joint interest.

The suggestion has also been advanced that an earlier meeting date be given consideration. The present meeting date, near the end of December, gives very little time for the findings of the two groups to be translated into a practical program for the coming season. A meeting date early in December, it is pointed out, would allow a little more time for new programs to be drawn up in the light of the previous season's findings.

We are not unaware of obstacles lying in the way of holding one joint meeting of the A. A. E. E. and the A. P. S. early in December each year, but we do have a feeling that such an idea deserves consideration by leaders of each group.

Progress in manufacture and use of

FERTILIZERS

by

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TREMENDOUS increases in both production and consumption of plant food in the U. S. have been recorded within the past few years. The consumption of nitrogen, phosphoric oxide and potash in 1946, for instance, was 3,084,000 tons . . . an increase of 102 percent over the 1930 figures, and 277 percent over the lowest consumption in subsequent years.

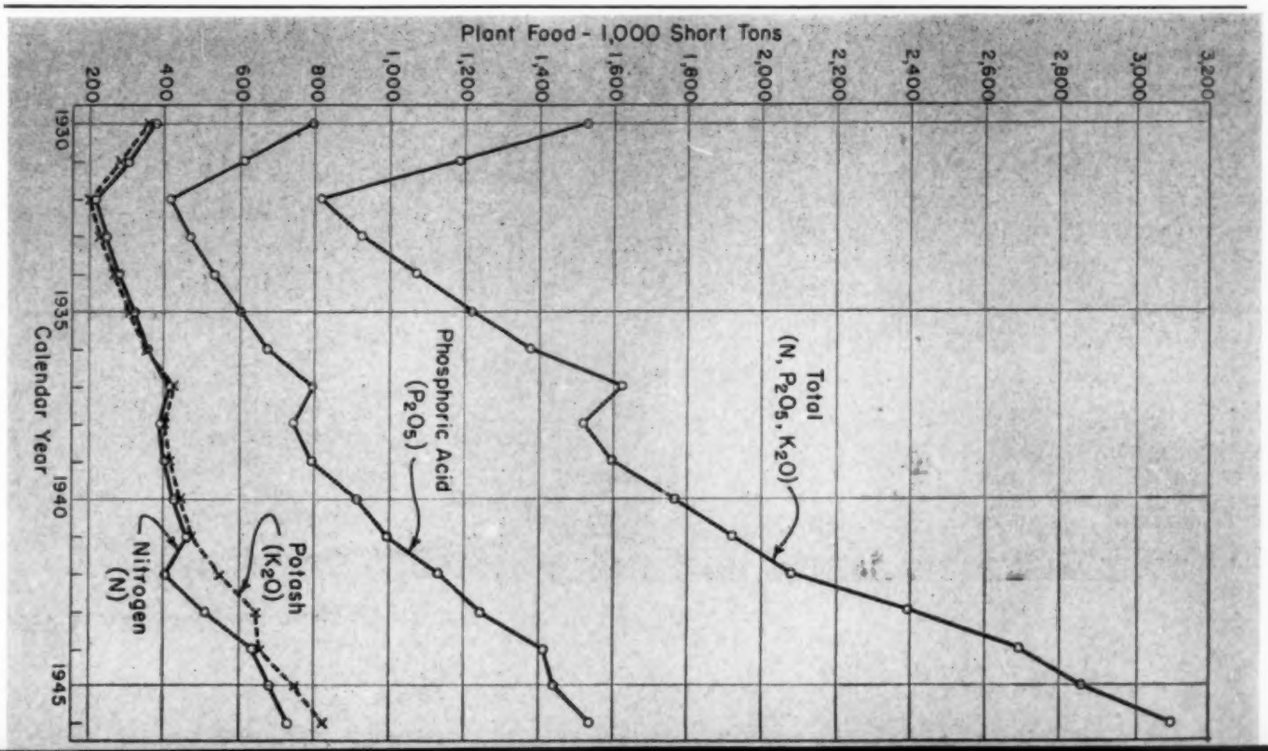
Reasons for this significant increase in consumption are threefold: higher farm incomes; augmented wartime and postwar production; and a growing recognition of the need for increased use of fertilizer in the maintenance and improvement of soil fertility. These factors were chiefly responsible for the setting of new annual records in total plant food consumption each year beginning with 1940.

The average plant-food content of commercial fertilizer rose gradually from 18.1 percent in 1930 to 20.4 percent in 1946, an increase of 12.7 percent. Translation of the increase into terms of fertilizer tonnage serves to emphasize its importance. Thus, if the average percentage had remained at the 1930 level, an additional 1,920,000 tons of fertilizer would have been needed to supply the plant food used in 1946. Provision of the additional labor and transportation required for the manufacture and movement of such a volume of material under the prevailing conditions, would certainly have presented most serious, if not insurmountable, difficulties. For 1946, this increase in plant-food content represented a saving to farmers of at least $5,000,000 in freight charges alone.

Nitrogen Fertilizers

ASIDE from natural organic materials, the total capacity for production of chemical nitrogen in the United States now amounts to some 1,500,000 tons annually, or about 1.5 times the domestic consumption of chemical nitrogen for all purposes in 1946. Besides privately owned by-product and synthetic ammonia plants, the capacity includes approximately 900,000 tons of nitrogen in 10 synthetic ammonia plants built with Government funds during the war. As a result of the war-induced expansion in synthetic ammonia capacity, the nation has been provided with adequate nitrogen producing facilities for the first time in its history.

The principal sources of fertilizer nitrogen used in 1946 were by-product ammonium sulfate, sodium



nitrate, ammoniating solutions, and solid ammonium nitrate, which together accounted for about 85 percent of the domestic consumption of nitrogen as fertilizer. Although the natural deposits in Chile supplied most of the sodium nitrate, a substantial quantity was made from synthetic ammonia by a process established in this country more than 15 years ago. During the war a small tonnage of sodium nitrate was made as a byproduct of the manufacture of a military explosive. The ammoniating solutions and solid ammonium nitrate are of special interest—the first because they afford a ready means for the utilization of large quantities of free ammonia in the manufacture of mixed fertilizers, and the second because its extensive use as a fertilizer in the form of the nearly pure salt was strictly a wartime development.

Nitrogen fertilization of crops by addition of anhydrous ammonia to irrigation water has become a rather common practice in certain sections of the west, notably in California and Arizona, but the quantity used in this manner is small compared with the total consumption of fertilizer nitrogen in the west. Equipment has recently been developed for injecting anhydrous ammonia directly into the soil, as well as for applying aqueous ammonia as fertilizer. It is estimated that anhydrous ammonia was applied directly to some 200,000 acres of land in the Mississippi Delta in the spring of 1947.

Ammoniating Solutions

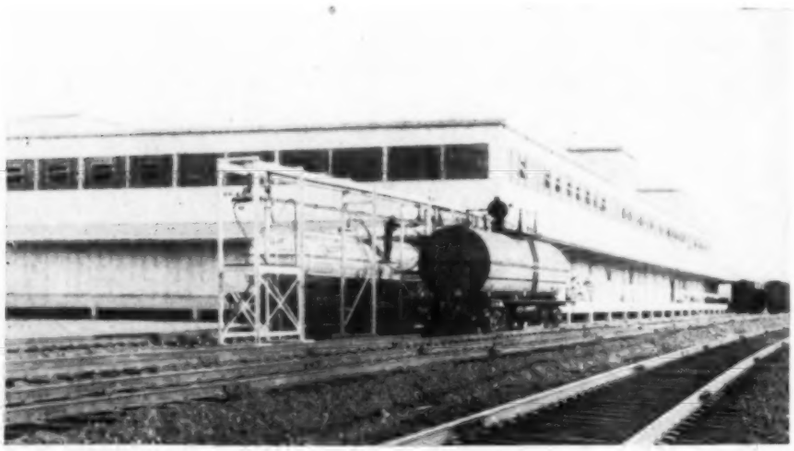
THOUGH not a new development, the use of ammoniating solutions consisting of ammonium nitrate or urea dissolved in aqueous ammonia was important in the wartime supply of nitrogen fertilizers. Since these solutions contain 37 to 45 percent of total nitrogen, including 13 to 25 percent of nitrogen as free ammonia, they are among the most concentrated of the readily utilizable nitrogen fertilizer materials. They furnish nitrogen in one of its cheapest forms, and they provide an easy means for the direct addition of free ammonia to mixed fertilizers. Aside from the cost factor, these advantages assume added importance under wartime conditions of transportation and labor.

The consumption of nitrogen in the form of ammoniating solutions, ammonia liquor, and anhydrous ammonia increased from 65,000 tons in 1941 to about 185,000 tons in 1946. In 1946 some 70,000 tons of nitrogen as free ammonia were added directly to mixed fertilizers by such means, thereby eliminating the necessity for its prior conversion into salts. Otherwise, the lack of sufficient conversion facilities would have precluded the utilization of much if not all of this ammonia at a time when adequate supplies of nitrogen fertilizer were urgently needed.

Solid Ammonium Nitrate

MANUFACTURE of nearly pure ammonium nitrate in forms suitable for use directly in mixed fertilizers and for separate application to the soil is probably the most important recent advance in the technology of fertilizers. Early in 1943 ammonium nitrate from several plants in the United States and Canada became available for use as fertilizer. Because of its pronounced tendency to cake and to absorb moisture from the air, however, the product first marketed met with general disapproval. Nevertheless, the material offers several advantages: It is a concentrated product containing more than 32 percent of nitrogen equally divided between the ammonium and nitrate forms; it is a low-cost source of nitrogen; and its agronomic value compares favorably with that of other nitrogenous materials. The prevailing shortage of nitrogen fertilizers, furthermore, together with the lack of facilities for producing other materials in lieu of ammonium nitrate, emphasized the necessity for every effort to make the nitrate acceptable to farmers and the fertilizer industry. The problem was attacked immediately by industry and Government agencies and a satisfactory solution was reached, with the result that 271,000 tons of ammonium nitrate, containing 89,000 tons of nitrogen, were used in the United States in the calendar year 1945.

The product, as now marketed, is composed of granulated or grained particles containing 32.5 to 33.5 percent of nitrogen. The particles are coated with 3 to 4 percent of diatomaceous earth or clay to lessen caking of the material during its transportation and storage, and, in some cases, with 1 percent of a water-repelling agent. Shipment is usually made in multiwall paper bags containing two asphalt-laminated layers. Material thus treated and bagged can be stored for long periods under high atmospheric temperature and humidity without excessive caking and moisture absorption.



Modern fertilizer-mixing plant, showing tank cars of ammoniating solutions in foreground. (Photo courtesy Eastern States Farmers' Exchange)

Airplane view of plant for extraction of potash from Searles Lake brine, Trona, California.

Urea-form

A NEW type of synthetic nitrogen fertilizer, consisting of reaction products of urea and formaldehyde aand containing about 37 percent nitrogen, is being developed by the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. D. A. The material, to which the name Urea-form has been given, is only slightly soluble in water and is nitrified slowly in the soil. Because it supplies available nitrogen to plants over a long period of time, it offers much promise as a fertilizer for grass, as well as for other crops which ordinarily need supplemental applications of nitrogen during the growing season. As Urea-form can absorb considerable water without undergoing undesirable changes in physical condition, it offers attractive possibilities as a high-analysis anti-caking and conditioning agent for mixed fertilizers to replace the inert or low-analysis materials commonly used for this purpose.

Phosphate Fertilizers

FOR more than 75 years the United States, by virtue of the successive discovery and development of the phosphate deposits of South Carolina, Florida, Tennessee, and the West, has been independent of foreign sources of phosphate for fertilizer. Through these years a capacity was built up for the production of phosphate rock and phosphate fertilizer considerably in excess of the requirements of the domestic and export trades. It was this extra capacity that enabled the industry to meet the greatly expanded wartime demand for phosphate fertilizer with little new construction and to an extent conditioned principally by supplies of labor and sulfuric acid.

Ordinary Superphosphate

THE term "ordinary superphosphate" refers to the product, usually containing 18 to 21 percent of available P_2O_5 and consisting of a mixture of approximately equal parts by weight of monocalcium phosphate and calcium sulfate, made by treating raw phosphates with sulfuric acid. The term is synonymous with the terms "normal supherphosphate" and "standard superphosphate."

For years ordinary superphosphate has supplied most of the domestic needs of P_2O_5 as fertilizer; but in recent years the proportion has been more than 90 percent. The output of ordinary superphosphate in 1946 amounted to 7,847,591 tons, containing 1,412,566 tons of available P_2O_5, produced by 161 plants scattered throughout the United States; this was an increase of 79 percent over the production in 1941. According to a survey made by the War Production Board in 1945, the "practical operating capacity" of superphosphate plants in the United States totaled 2,068,000 tons of P_2O_5 annually, of which 80 percent was located in the old fertilizer-consuming areas of the south and east. Since this survey the practical operating capacity has been increased by more than 180,000 tons of P_2O_5 by additions to existing facilities and construction of new plants.

The ability of the superphosphate industry to utilize spent sulfuric acid from other industries, was a highly important factor in the wartime fertilizer supply. The explosives industry was the most important source of spent acid. Large quantities of superphosphate were also made with acid that had been used in the production of aviation gasoline by an alkylation process. Other sources of spent acid included the petroleum refineries, pigment manufacture, metal refining and treating plants, and dye and alcohol factories.

Reduction in the moisture content of ordinary superphosphate has been effected by the use of stronger sulfuric acid and other means, with the result that the grade of superphosphate obtainable from a given grade of phosphate rock has been increased. Much attention has been given to the granulation of superphosphate for the purpose of improving its physical condition and facilitating its application to the soil. Increased production of the granular material is anticipated. A new continuous process for making superphosphate was developed during the war and is in operation at one plant.

Double Superphosphate

BECAUSE of its higher concentration, the costs involved in bagging, handling, and transporting double superphosphate per unit of P_2O_5 are lower than those of ordinary superphosphate. (The term double superphosphate refers to the product, usually containing 45 to 50 percent of available P_2O_5, made by treating raw phosphates with phosphoric acid. The term is synonymous with the terms "triple superphosphate" and "treble superphosphate.") These savings tend to counterbalance the lower manufacturing cost of ordi-

nary superphosphate, so that in certain sections of the country—notably large areas of the middle west and the far west—double superphosphate is usually the cheaper material on a delivered-to-the-farm basis. Double superphosphate is an important source of P_2O_5 for manufacturing high-analysis mixed fertilizers.

New records for production of double superphosphate were established in each of the years 1936 to 1940 with the output increasing steadily from some 58,500 to 151,500 tons of available P_2O_5. Subsequently the production decreased somewhat, chiefly because of the diversion to military use of large quantities of elemental phosphorus which otherwise would have been made into double superphosphate. The 1946 production of double superphosphate amounted to some 145,044 tons of P_2O_5.

Currently, there are seven plants in the United States actively engaged in the manufacture of double superphosphate. Of these plants, five make phosphoric acid by the sulfuric acid process and one (the Tennessee Valley Authority) by the electric furnace process. The other uses spent phosphoric acid from industrial operations. On the basis of installed facilities, the total capacity of these plants for annual production of double superphosphate is estimated to be in the neighborhood of 220,000 tons of available P_2O_5. Another plant, which formerly made double superphosphate, changed in 1946 to production of a mixture of ammonium phosphate and ammonium sulfate containing 16 percent nitrogen and 20 percent P_2O_5. Plans have been announced for the construction of four new double superphosphate plants, three in Florida and one in Idaho.

Certain deposits of phosphate rock in the Rocky Mountain region contain appreciable percentages of vanadium, which finds its way into the phosphoric acid produced from such rock by the suifuric acid method. A process for the recovery of the vanadium was recently developed and placed in operation at a large double superphosphate plant in the west. Important quantities of vanadium urgently needed for the war effort were obtained in this way.

Defluorinated Phosphate

THE commercial grades and types of phosphate rock commonly produced throughout the world contain fluorine, which is present as insoluble combinations with the phosphate. The destruction of these fluorine-phosphate compounds is the primary object of all chemical processes for the manufacture of fertilizers from phosphate rock.

Some 15 years ago the Department of Agriculture initiated studies of the reaction between phosphate rock, silica, and water vapor at high temperatures, whereby substantially complete volatilization of the fluorine can be effected and the phosphate converted into the citrate-soluble (available) condition. This work, together with pilot-plant investigations and further laboratory researches by T.V.A., and a number of fertilizer and phosphate rock companies, led finally to large-scale production of defluorinated phosphate rock by the Coronet Phosphate Company in 1944. (The term "defluorinated phosphate" rock covers the products variously referred to as calcinated phosphate, fused phosphate, fused phosphate rock, fused tricalcium phosphate, and alpha phosphate.) The product of this plant, which is now located at Plant City, Florida, contains about 20 percent of P_2O_5. Although it has been used principally as a source of phosphorus in animal feeds, a considerable quantity has been consumed as fertilizer. More recently the T.V.A. has constructed a large plant near Columbia, Tennessee, for the manufacture of defluorinated phosphate rock, primarily for fertilizer use, by a process which yields material having a higher percentage of P_2O_5. The Authority produced about 15,800 tons of this material in the year ended June 30, 1946.

There is good evidence that defluorinated phosphate rock is a satisfactory source of P_2O_5 for crops growing on acid and neutral soils, particularly legumes, pasture, forage crops, and cereals in rotation. As the material is alkaline in reaction, it is not suitable for use in the preparation of mixed fertilizers containing ammonium salts.

Calcium Metaphosphate

A PROCESS for the manufacture of calcium metaphosphate by reacting P_2O_5 vapor with phosphate rock at approximately 1000°C., has been developed by T.V.A. The P_2O_5 is produced by combustion of elemental phosphorus manufactured in the electric furnace. About 8,100 tons of metaphosphate were produced by the Authority in the year ended June 30, 1946.

The material is obtained in the form of a glass containing about 62 percent of available P_2O_5. It is nearly insoluble in cold water but is soluble in neutral ammonium citrate solution. The fertilizing value of the product appears, in general, to parallel that of defluorinated phosphate rock.

Other Production Methods

LARGE-SCALE manufacture of a fertilizer by fusing a mixture of phosphate rock and magnesium silicate (in this case, serpentine) in the electric furnace was started in 1946 by the Permanente Metals Corporation, Permanente, California. The product, obtained essentially in the form of a glass by cooling the molten mass quickly, contains about 20 percent total P_2O_5. It is marketed under the name of "Thermo-Phos." Thus far, tests of the nutrient value of the material appear to have been made on only a limited scale and with only a few kinds of plants.

Potash Fertilizers

PRODUCTION of potash to meet the nation's domestic requirements was an outstanding accomplishment of the war period. This achievement was made possible chiefly by

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by

Dr. W. J. Hamilton
Professor of Zoology
Cornell University

RATS and their kin; ground squirrels, field mice and other rodents, have for untold generations plagued man. These mammal pests continually spread pestilence and disease, and destroy tremendous quantities of foodstuff which the nation can ill-afford to lose at any time, and particularly not during the present period of necessary conservation of food. Annual damage caused by these rodents in the U. S. has been placed at a third of a billion dollars, but many persons qualified to know, consider this estimate too low.

Attempted control of these pests has been continued over the centuries often with only desultory results. Community effort is essential in any effort to reduce these losses. Poisoning, trapping, gassing and rat proofing have all received attention; but in large scale efforts to reduce rats and field rodents, poisoning has proved to be most effective.

The successful chemical control of rats and other rodent pests makes necessary a knowledge of the habits of these animals. Government and state bulletins on the subject will provide the information essential for such a campaign. The principal objection to poisoning is that most poisons used (excepting red squill) will destroy any and all animals which happen to eat the poisoned bait. There is also the likelihood of objectionable odors emanating from animals that have died within the recesses of buildings. A slow-acting poison, placed where rats have free access to the outdoors will minimize danger from such a hazard.

If poisoning operations are to be successful, the proper quantity of poison must be thoroughly incorporated with an attractive bait. Rats, unless starved, are fastidious creatures and will pass by what appears as a most attractive meal when other foods, more to their liking, are at hand.

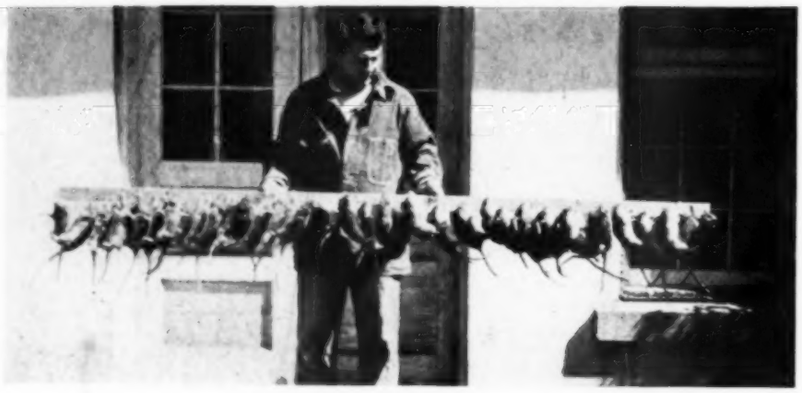
In a campaign against rats, where poison is to be widely used, a preliminary trial of various foodstuffs exposed to the rats will be most worthwhile. In this manner, one can best determine the predilection for any bait, and act accordingly. A list of baits that have proved satisfactory is given. These baits may be used as the base for any poison.

A. Cereals (cooked or plain), such as oatmeal, cornmeal, hominy, flour.
B. Meat, such as hamburg, bacon, suet, tallow, lard.
C. Fish, such as canned sardines, canned salmon, fresh mackerel, haddock.
D. Milk products, such as raw milk, cheese, butter.

Fresh fruits also make good baits. Melons, tomatoes, pumpkins, cherries, bananas, apples, and green corn are excellent, and under certain conditions, provide an attractive bait.

A large salt shaker, kept for the express purpose of mixing rat bait, is effective in coating melons, tomatoes, apples, and other fruits with poison. If a shaker is not available, the poison may be spread on with a knife or a wooden spatula carved from a shingle. If meat, meal, or dough is used, the poison can be incorporated with the fingers or a flat stick.

Rats invading a chicken house at night. Such rodents cause great annual damage in agricultural regions, both in brood houses and in stored grain. (Photo courtesy Esso Farm News)



One night's kill in a poultry house. These rats had been eating enough mash to feed at least a dozen hens, in addition to their destruction of little chicks.

It seems hardly necessary to add that all foodstuffs should be removed in a poison campaign. To destroy rats, it is necessary that they eat the poisoned baits. The chances of this are greatly lessened if available unpoisoned food is lying about.

Many small baits are more effective than a few large ones. Furthermore, it is preferable to place the bait some little distance from the hole. This will prevent the rats from becoming unduly suspicious. In poisoning city blocks or large industrial areas, the poisoned bait should be wrapped in small squares of wax paper or paper cake cups to facilitate retrieving the baits. It is imperative that all uneaten baits be removed, and either buried or burned.

Prebaiting consists of exposing fresh unpoisoned baits, prepared exactly as the poisoned baits. The bait is put in places frequented by rats. It is best to use several kinds of foods, such as ground meat, fresh or canned fish, chopped or diced vegetables, and various cereals. By exposing such baits for several successive nights, one may determine the kind of bait favored by rats and where and in what quantity such baits are taken. By exposing a teaspoonful of the various baits side by side, the favorite bait may be selected. Uneaten baits are removed each morning and fresh baits are placed in the evening. When the most attractive bait is found one should wait a night or two before placing the poisoned baits. Although prebaiting may increase the chance of success in poisoning, it is not often done, and in times of food scarcity does not seem practicable.

Red Squill

RED squill is a perennial bulbous plant, *Uriginea maritima*, which grows wild in the Mediterranean area. The pear shaped bulbs weigh from one to ten pounds. It is necessary to dry red squill under controlled temperature conditions in order to obtain a powder of maximum toxicity. Sliced bulbs held at a temperature of 176°F. until thoroughly dried will provide the most toxic powder. The squill does not deteriorate if thoroughly dried and kept in a tight container. Fortunately, red squill is a specific poison for rats, being relatively harmless to other animals. Domestic animals either refuse red squill baits, or if eaten, promptly vomit the poisoned food. Cats and dogs particularly indicate an aversion for squill.

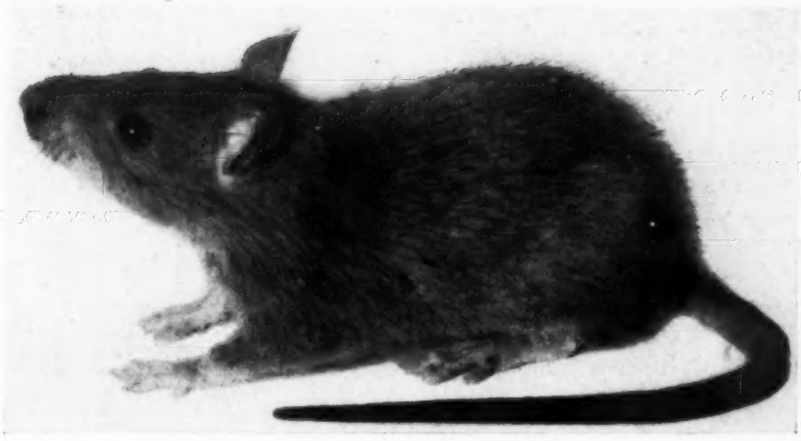
During World War II, the problem of importing red squill became increasingly difficult, and the marketable products in the United States were found to vary greatly in their toxicity, irrespective of price. In order to make available a standardized red squill powder of sufficient potency to be highly effective in rat control, a method of fortification was devised. Through "fortification" this weaker squill can be made more highly toxic and still retain the safe emetic factor possessed by the original powder.

Red squill powder is mixed with suitable baits at the ratio of one part of squill to sixteen parts of bait by weight. Poison can be incorporated with fresh meats or fish, meal, grains, or sprinkled on melon or tomatoes. The writer has mixed red squill with mash in poultry hoppers with considerable success. Due to its specificity and relatively harmless effect on animals other than rats, squill has met with great favor in agricultural use for farmers troubled with these pests. It should be borne in mind that the relative toxicity of squill is less than other widely used rodenticides, with the exception of barium carbonate.

Sodium Fluoracetate

THE compound "1080" (sodium fluoroacetate) has been widely hailed as a rodenticide. Unfortunately, it is highly toxic to all animal life, even in relatively minute quantities. It is therefore recommended for use only by responsible and qualified persons, such as federal, state, county and municipal officers, and experienced professional pest control operators. It is not recommended for use by the general public, and fortunately is not available to the public at the present time. Compound "1080" is chemically stable, is very soluble in water, but relatively insoluble in organic solvents such as kerosene, alcohol, acetone, or in animal or vegetable fats and oils. When powdered "1080" is exposed to air, it takes up water from the atmosphere and becomes quite sticky. It should not be heated above 270°F. in preparing any bait.

The high solubility of "1080" in water makes the preparation of baits easy and accurate. Baits poisoned with this compound are more resistant to weathering than baits carrying other poisons. There is, however, a hazard in contaminating drinking water. Since this poison is absorbed by the digestive tract in lethal quantities before its effects are felt, it is superior to many other poisons. Rats which survive one poisoning may develop an aversion to "1080" during successive operations,



The Norway rat, most common rodent pest in the U. S and a menace to agriculturalists for generations, can be controlled by proper use of various poisons.

thus reducing the efficiency of the repeated use of this poison. All users of "1080" *must* realize that its presence as a contaminant in food or water might be unrecognized because of a lack of particular taste or odor. A coloring agent is recommended to differentiate the compound from flour, baking powder, or powdered sugar which "1080" resembles in its natural state. Operators should neither smoke nor eat while handling the poison, in order to keep the hands away from the mouth. Compound "1080" should be used only in commercial or business establishments and on guarded municipal dumps.

As a rodenticide, it may be used in several ways. One-half ounce of "1080" per gallon of water is the recommended concentration. This preparation is effective against the three common rats and the house mouse. Poisoned water should be dispensed carefully by syringe in shallow ¾ ounce waxed paper souffle cups. About ½ ounce per cup is sufficient. The containers should be placed at 12 foot intervals in prepared poison boxes or behind boxes and boards leaning against the wall. Following poison operations, the containers should be picked up and *burned*. If solid baits are used, one ounce per 28 pounds of food bait is recommended for the concentration. Thorough mixing is best obtained by mixing the bait with five times its own weight of wheat flour. Records should be kept of the locality and number of all baits and particular effort made to recover all uneaten baits at the close of operations.

"ANTU" Effective

ANTU (Alpha-Napthylthiourea) is a relatively new rat poison. It was developed and tested by Dr. Curt P. Richter of Johns Hopkins University, and within the past two years has gained wide acceptance. Antu is an effective poison for the brown or Norway rat but is not particularly effective for the roof and black rat or other rodents. It has a high toxicity for the brown rat and a relatively low toxicity for other rodents. This compound is a finely granulated gray powder, insoluble in water but soluble in some organic solvents including ethyl alcohol and acetic acid. Antu is chemically stable, non-volatile, non-toxic and non-irritating to the human skin. Compared with other rodent poisons, Antu ranks second only to "1080" in its toxicity to the Norway rat, requiring approximately 7 milligrams of poison per kilogram of body weight to kill 50 percent of the animals. The Norway rat quickly builds up a tolerance for Antu, indicating that this poison should not be used in an area at intervals of less than four or five weeks. If additional control is required, squill, "1080," or some other poison should be used. Antu kills rats by causing an acute lung dropsy and an accumulation of fluid in the chest cavity. Death usually occurs within 12 to 48 hours. The first symptom of poisoning is a sharp drop in body temperature.

Antu is used in several ways. A 2 to 3 percent concentration in baits of the usual type, dusted lightly on and about freshly cut vegetables; dusted lightly on the surface of water and finally as a contact poison. This latter method is effective in eliminating the last survivors in rat-proofed buildings. Antu may be mixed with equal parts of dust, flour or pyrophyllite and placed in patches on floors against the walls, on cross studding or pipes. It may be blown into the burrows or holes with a standard dust pump, such as is used in applying "cyanogas." The writer has found this latter method most effective. Rats will lick the poison from their feet and thus ingest a lethal dose.

Zinc Phosphide

ZINC phosphide has been used widely in recent years for the control of orchard mice (*Microtus*), and is equally useful for rats. This compound is highly toxic and will kill all forms of animal life if eaten in proper amount. The poison is issued by agents of the Fish and Wildlife Service, U. S. Department of the Interior. It is issued in small cans containing 15 grams of the rodenticide, part of which is a filler. The contents of a can are sifted over two pounds of bait (for smaller lots, one teaspoon to 3 ounces of bait). Sifting the contents on two pounds of diced carrots or apples, or thoroughly incorporating with a large box of oatflakes, will prove effective in the control of orchard mice if the bait is placed directly in the runways of the mice. Broadcasting the poisoned bait in an orchard has proved futile.

Other poisons widely used in the U. S. and elsewhere are powdered white arsenic (arsenious oxide), phosphrous, strychnine, thallium sulphate and barium carbonate.

Arsenic

ARSENIC is poisonous to all animals. It has the great advantage of being odorless and tasteless

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Use of DDT and H.E.T.P. as

Aerosols in Greenhouses

DURING the last five years insecticides in liquefied-gas aerosols have been tested against a variety of insects in experimental greenhouses at Beltsville, Md., and in commercial greenhouses in Indiana, Ohio, Maryland, Pennsylvania, New Jersey, and Connecticut. Nicotine in an aerosol was found to be twice as effective against the green peach aphid as it was in smoke from a widely used combustible powder in a pressure can (Smith and Goodhue 1943). Lorol thiocyanate was equally effective in aerosols and in sprays against cyclamen mites on snapdragon (Goodhue and Smith 1944). DDT aerosols were effective on thrips, whitefly adults, certain aphids, sowbugs, the American roach, ants, and crickets (Smith and Goodhue 1945).

More recent greenhouse studies have shown that DDT aerosols are effective against the greenhouse leaf tier, azalea leaf miner, rose midge, fungus gnats, centipedes, and on some plants against the broad mite. Preliminary tests with aerosols containing a benzene hexachloride of high gamma-isomer content indicated that is was highly toxic to aphids but that an unpleasant odor persisted in the greenhouse for several days after application.

Recent studies (Smith *et al.* 1947) with hexaethyl tetraphosphate in aerosols have shown that this material is highly toxic to the active stages of the two-spotted spider mite, or red spider, to 10 species of aphids found in greenhouses, to adults of the greenhouse whitefly, and to the Mexican mealybug and the citrus mealybug, but not to 2 species of snail or to the broad mite. The present discussion will be confined to aerosols containing DDT or hexaethyl tetraphosphate.

Aerosol Formulations

THE liquefied gas Freon-12 (difluorodichlomomethane) has been used exclusively as the propellant for preparing the DDT aerosols for greenhouse use. A number of solvents for DDT were tested in various formulations, but most of them were discarded because of a number of reasons. These faults included container corrosion, plant injury, crystallization in the container at low temperatures or at the nozzle during application, or irritation to the operator. The solvents influenced the effectiveness of the insecticide and the physical properties, particularly the particle size.

Because formula 104 has been very efficient insecticidally and has been applied without injury to most greenhouse crops, it has been most generally used in greenhouse treatments. Cucumbers, however, are susceptible to injury by aerosols containing cyclohexanone, and for this crop formulas 86 and 87 have been employed. The cyclohexanone in formula 104, in addition to being a good solvent, appears to act as an irritant to thrips, whitefly adults, and greenhouse leaf tier adults, so that they move about and are killed more rapidly than when formulations lacking it are applied. The acetone is added in formulas 104 and 87 to prevent crystal formation in the solution at low temperatures, but according to our tests is not needed in formula 86 except where the solution has been kept for 6 months or longer.

Because hexaethyl tetraphosphate is soluble in methyl chloride, no auxiliary solvents were required when it was used with this propellant. The most extensively used formula contained 10 percent of hexaethyl

TABLE I

The following formulas[1] containing DDT have been used successfully in greenhouses (figures in percent):

Ingredient	Formula 86	Formula 87	Formula 104
DDT (technical)	5	5	5
Cyclohexanone	—	—	5
Velsicol AR-60 (methylated naphthalene)	10	5	5
Acetone	—	10	3
Freon-12	85	80	82

[1] Numbers refer to formulas of aerosols tested at the Agricultural Research Center against agricultural pests.

by

Floyd F. Smith
R. A. Fulton and
Philip Brierley

Agricultural Research Administration
U. S. Department of Agriculture[2]

It is necessary for person applying toxic insecticides to wear gas mask when working in confined spaces such as greenhouses. This method has proved effective in pest control.

tetraphosphate[3] in anhydrous methyl chloride (formula 106). Two other formulations have been tested to a limited extent—(*a*) hexaethyl tetraphosphate 10, methylene chloride 20, and Freon-12, 70 percent (formula 108); and (*b*) hexaethyl tetraphosphate 20, methylene chloride 40, and propane 40 percent (formula 109). Hexaethyl tetraphosphate in formula 106 was found to be more effective against aphids and spider mites than when applied at the same concentrations in these formulations.

Aerosol Dispensers

IN early experiments the aerosol, in a one-pound container suspended by a string in the greenhouse, was discharged through a 2-gallon-per-hour oil-burner nozzle (Smith and Goodhue 1945, and illustrated on cover page of AGRICULTURAL CHEMICALS, Vol. 1, No. 1, May 1946). A more recently developed knapsack dispenser (Smith 1946, Goodhue 1946) consists of a cylinder containing the aerosol solution, a synthetic-rubber charging hose about 36 inches long, a 24-inch length of 1/8-inch brass pipe, and a 5-gallon-per-hour oil-burner nozzle. The nozzle body, nozzle tip, and screen are made of brass, bronze, or other noncorrosive alloy such as stainless steel, because nozzle parts of iron corrode in the presence of the hexaethyl tetraphosphate aerosols. Threaded joints or silver solder should be used in making all connections because lead-tin solder is attacked by hexaethyl tetraphosphate. Stainless steel oxygen tanks and steel cylinders for refrigerant gas fitted with suitable valves without fusible plugs have been used as containers for the aerosol solutions.

Experiments have also been conducted with a dispenser[4] equipped with a solenoid valve. The cylinder of aerosol solution is suspended by a bracket above the tops of the plants in the greenhouse and is fitted with a solenoid valve equipped with a multiple nozzle that discharged the aerosol in four directions. The valve is actuated by an electric connection operated by a switch outside the greenhouse.

In dispensing the DDT aerosol the operator need not wear a respirator unless he is irritated by the included solvents. *Because of the toxicity of both hexaethyl tetraphosphate and methyl chloride, however, the operator applying these materials with a knapsack dispenser must follow suitable precautions and wear a gas mask with a canister designed for protection against organic vapors.* A mask is not needed for operating the solenoid dispenser, unless it is necessary to re-enter the greenhouse during the night.

The Interdepartmental Com-

2 The first two authors are entomologist and chemist, respectively, in the Bureau of Entomology and Plant Quarantine, and the third author is pathologist in the Bureau of Plant Industry, Soils, and Agricultural Engineering. Photographs are by W. J. Mead of the Bureau of Plant Industry, Soils, and Agricultural Engineering, and J. J. Chisholm of the Department of Entomology, University of Md.

3 The hexaethyl tetraphosphate used in all tests was a commercial grade prepared by the Schrader process described in U. S. Patent 2,336,302, issued December 7, 1943.

4 W. J. Wilder, Virginia Smelting Co., West Norfolk, Va., cooperated in designing and assembling this dispenser.

mittee on Pest Control in a memorandum dated April 3, 1947, recommended the following precautions in handling hexaethyl tetraphosphate:

1. Avoid contact with the skin, especially when handling the concentrated material. Gloves impervious to hexaethyl tetraphosphate should be worn. If skin is accidentally contaminated, wash carefully with soap and water immediately. Individuals should be required to keep shirts buttoned at the neck, sleeves down and buttoned at the wrist.

2. Avoid the inhalation of hexaethyl tetraphosphate mist, dust, or aerosol by wearing a respirator or mask approved by the U. S. Bureau of Mines.

3. Adequate personal hygiene and cleanliness of the operation is necessary. At the end of the operation the clothing should be removed, followed by a thorough bath with warm water and soap.

4. Avoid contamination of food; smoking and chewing tobacco, and eating should be prohibited in the operating areas.

5. Any persons developing symptoms of headache or tightness of the chest when using hexaethyl tetraphosphate should be removed from the exposure. In the case of ingestion of hexaethyl tetraphosphate an emetic, such as mustard or warm soapy water, should be used immediately and the patient referred to a physician.

6. A dye should be added to hexaethyl tetraphosphate in such a concentration that it will be readily detectable in the final insecticide solution.

Preparing Aerosols

LABORATORY procedure for filling the tanks with the DDT aerosol solution is rapid and requires no special apparatus. The tank is first cleaned by evacuating and then rinsing it several times with dry acetone. The acetone is removed by opening the valve and then connecting the tank to an air-pressure system. The process is repeated until the acetone from the cylinder is clear. The tank is then dipped into hot water to warm it, and connected to a vacuum system; after 30 minutes the valve is closed and the tank is disconnected from the vacuum. A short length of copper tubing with a flared fitting is attached to the evacuated tank, and a weighed solution containing DDT is drawn in. The tank is then connected to a cylinder of Freon-12 by means of a regular refrigeration charging hose, and the valve on this cylinder is opened to fill the hose. The aerosol tank is weighed before its valve is opened. After the proper amount of Freon-12 has flowed in, both valves are closed and the connection to the tank is unscrewed slowly to allow the liquefied gas in the hose to escape, care being taken to protect the eyes with glasses or goggles. The aerosol is then ready.

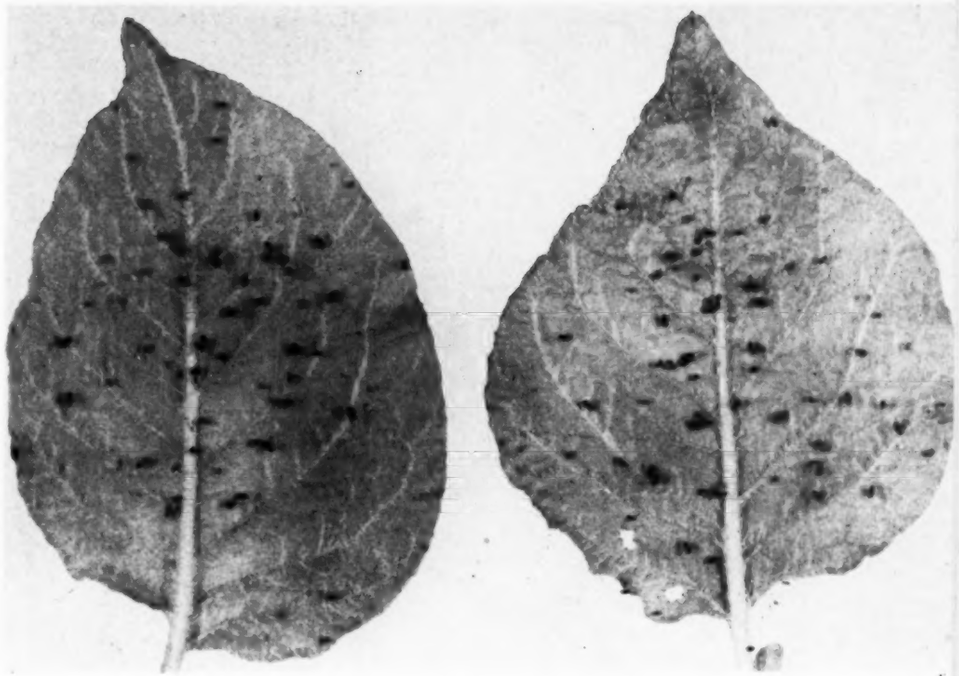
Procedure for filling the tanks with hexaethyl tetraphosphate aerosol solution is essentially the same as described above for filling with DDT aerosols. Hexaethyl tetraphosphate is hydrolyzed with water; it is therefore essential to avoid every trace of water by handling the materials under anhydrous conditions.

The Y valve in the tank is first removed and the tank is washed thoroughly with hot water, and rinsed until the water is clear. It is then dried by inverting in a rack over a steel or copper tube connected to a source of compressed air. The compressed air may be heated before it enters the cylinder to reduce the drying time. The Y valve is then screwed in and the tank washed several times with dry acetone and finally evacuated in the manner described for the DDT aerosols. It is then connected by means of copper tubing to a flask containing a measured quantity of hexaethyl tetraphosphate that is protected from moist air by a calcium chloride tube. The hexaethyl tetraphosphate is slowly drawn into the tank with care to avoid admitting any air. The copper tube is then disconnected, and the aerosol tank is connected to the cylinder of methyl chloride. It is necessary to keep all flames away during the filling operation because methyl chloride is inflammable.

In preparing the hexaethyl tetraphosphate aerosols the precautions necessary in handling methyl chloride or other toxic refrigerants should be followed. Extreme caution should be taken to avoid inhaling vapors of the gas or the completed aerosol. Any material spilled on the skin during the filling operation must be washed off immediately with soap and water.

The handling of liquefied gases is a specialized technique and is not recommended for the novice. (It is suggested that any person who plans to fill his own containers corre-

Aphids killed by hexaethyl tetraphosphate. Some of the dead insects had been killed before being able to withdraw their mouthparts from the plant.



Killed aphids still clinging to leaves of plant in greenhouse. Aerosols for greenhouse use have proved effective.

spond with the authors to procure details regarding the procedure.) Commercially prepared aerosol solutions for greenhouse use are now on the market.[5]

Aerosols in Greenhouses

THE knapsack dispenser developed for applying DDT aerosols in the greenhouse is handled in much the same way as a knapsack sprayer, with the aerosol tank carried in the hand or supported by a strap or harness over the shoulder. The aerosol is sprayed into the air above the plants by moving the nozzle from side to side as the operator walks slowly along the aisle of the greenhouse, and the mist settles among the plants behind him. From two to four beds or a strip 20 feet wide may be treated by one trip through the house. Wider houses are treated by two or more operators spaced at proper intervals or by repeated trips by the same operator. Any parts of the body exposed while applying the aerosol should be washed immediately after completing the application.

A single solenoid dispenser may be used to treat a greenhouse some 30 feet wide and 75 feet long. The unit is suspended in the center of the greenhouse and operated from outside by turning on the switch for the time required to discharge the aerosol. This unit should be particularly useful in small greenhouses, but is less practical than the knapsack dispenser for large ones.

In these experiments DDT in aerosols did not act as a fumigant, but settled on the plants and killed by contact or residual action. The dosage for any given greenhouse was therefore determined on a basis of area rather than of volume. Five grams of DDT, or 100 grams of aerosol solution, per 1,000 square feet of greenhouse, which is equivalent to approximately 10 pounds of solution per acre, appeared to be an adequate dosage. This dosage was discharged through one 5-gallon-per-hour nozzle in 34 seconds; at this rate 10 pounds would be dispensed in less than 25 minutes. At one of the world's largest greenhouse establishments a crew of three operators applied the material in greenhouses totaling 10 acres in approximately 90 minutes.

Since hexaethyl tetraphosphate in aerosol behaves in part as a fumigant, the dosage for this material was determined on the basis of the volume to be treated. A dosage of 1 gram of hexaethyl tetraphosphate, or 10 grams of aerosol solution per 1,000 cubic feet of greenhouse space was found to be adequate for control of the pests discussed in this paper. Most of the nozzles tested in our experiments discharged approximately 2.5 grams of solution per second.

Since nozzles may discharge aerosols at different rates, even though they bear the same rating by the manufacturer, it is desirable to calibrate each nozzle. The discharge rate for an uncalibrated nozzle for use in applying aerosols may be determined by reference to table 1. The time required to apply DDT aerosols may be determined by multiplying the ground area of the greenhouse, estimated to the nearest 1,000 square feet, by the discharge rate computed for that nozzle. In hexaethyl tetraphosphate aerosols the cubical content, estimated to the nearest 1,000 cubic feet, is multiplied by the discharge rate of the nozzle.

The aerosols containing DDT or hexaethyl tetraphosphate have been applied in full sunlight and on cloudy days, but usually near sundown when the ventilators could be closed. The ventilators have been kept closed for only about 1 hour after application of DDT, or until the particles have settled on the plants, but for at least 2 hours and in most instances overnight after application of hexaethyl tetraphosphate. The toxic ingredients of hexaethyl tetraphosphate have dissipated by morning after an all-night exposure. However, after a 2-hour exposure the greenhouse should be ventilated for 1 hour before one resumes work inside the place without a mask. DDT aerosols have been applied successfully at greenhouse temperatures ranging from 50° to 80° F. with little difference in effectiveness, but during exposure to hexaethyl tetraphosphate temperatures above 70°

(*Turn to Page* 61)

[5] The method of dispersing gas-propelled insecticidal aerosols is covered by U. S. Patent 2,321,023, issued June 8, 1943, to L. D. Goodhue and W. N. Sullivan and assigned to the Secretary of Agriculture. Information regarding licenses to manufacture and sell under this patent may be obtained fom the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington 25, D. C.

NFA Fall Meeting Views Role of

FERTILIZER in food production

THE importance of fertilizer in meeting world food needs was emphasized at the 21st annual Fall meeting of the National Fertilizer Association at Atlanta, Georgia, November 10, 11 and 12. Association president Maurice H. Lockwood stated in his address that one of the best ways for the fertilizer industry to help in the current program of food and feed conservation, is to promote the use this winter and next spring, of a larger proportion of the nation's commercial fertilizers on improved roughage production. This would make it practical to conserve feed and food in terms of grain concentrates. Mr. Lockwood also discussed the tendency for Government to enter further into the fertilizer field, and stated that although no bills are now pending, the industry cannot afford to lessen its vigilance against this possibility.

Declaring that the fundamental objective of the Association is "to foster the wise use of our industry's products, thereby increasing its contribution to agriculture and gaining for it the public regard," the NFA president warned against allowing this purpose to become obscured. He pointed out that in the stress of war and in the present post-war adjustments, with demand still at least slightly in excess of supply, the industry must not lose its bearings.

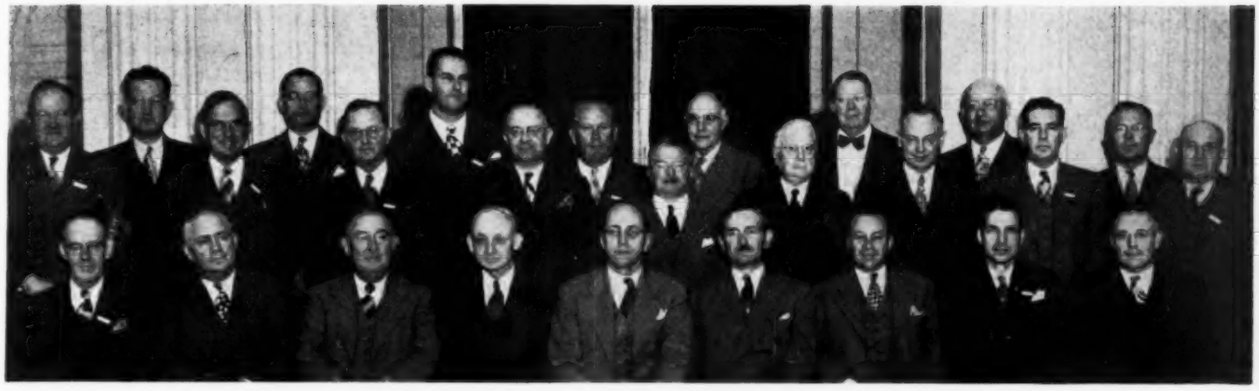
Regarding the supply of fertilizer materials, Mr. Lockwood stated that between the Army export program for occupied areas and our commercial exports, in addition to an unprecedented domestic demand, the U. S. is close to its present production potential in nitrogen. He said further that increased nitrogen production will be best accomplished if the plants currently operated for Army Ordnance are made available to commercial operators so that the latter may integrate the operation of these plants with nitric acid and graining units located near each of the ammonia fixation plants. He said that if ordnance supervision in such plants were replaced by fully commercial operation on a private enterprise basis, it would "be a healthy step for everyone concerned and will make it possible to begin now the process of integration so badly needed to make these producing units economically sound."

Above: Experts from the N.F.A. Plant Food Research Committee in session at annual fall convention in Atlanta. Left to right: Dr. H. B. Siems, committee chairman; Weller Noble, who presided at all sessions; J. E. Culpepper, D. D. Long, E. N. Carvel, R. N. Engle, J. A. Chucka, H. H. Tucker, Leroy Donald, J. A. Nattel, and H. E. Hendrickx.

As a means of offsetting increased costs of transportation between the point of original production and the field where the fertilizer is finally used, Mr. Lockwood suggested that the industry "plan ahead" to step up the concentration of products in order to keep the unit cost of nutrients on the land down to the "practical minimum." He predicted that although such a plan may not be the easiest thing in the world to accomplish, fertilizer manufacturers who follow such a plan will be in a stronger competitive position for having done it.

Omer J. Kelley, principal soil scientist, dept. of Agronomy, Colorado A&M College, Ft. Collins, Colo., told the group that under conditions of irrigation, it is particularly necessary to have maximum production which can be achieved only when other important factors affecting plant growth approach optimum conditions. He said that it is important to know not only the nutritional requirements of specific crops, but also to be acquainted with fertilizer programs for specific rotations and cropping systems. He presented figures to show the particular importance of such knowledge in irrigated crop production.

Further comment on the inter-



N.F.A. Board of directors and staff leaders assembled at Association's 21st annual fall meeting at Atlanta: (Seated) H. A. Parker, Sylacauga Fertilizer Co., Sylacauga, Ala.; John E. Powell, The Smith Agricultural Chemical Co., Columbus, Ohio; F. N. Bridgers, Farmers Cotton Oil Co., Wilson, N. C.; Daniel S. Murph, NFA Secretary and Treasurer, Washington, D. C.; Maurice H. Lockwood, NFA President, Washington, D. C.; Weller Noble, Pacific Guano Co., Berkeley, Calif., Chairman, board of directors; R. L. King, Georgia Fertilizer Co., Valdosta, Ga., vice-chairman; C. T. Prindeville, Swift & Co., Plant Food Div., Chicago, Ill.; E S. Russell, Old Deerfield Fertilizer Co., South Deerfield, Mass. (Standing) A. A. Schultz, Reading Bone Fertilizer Co., Reading, Pa.; J. L. Nichols, Sumpter Fertilizer Mfg. Co., Sumpter, S. C.; L. D. Hand, Pelham Phosphate Co., Pelham, Ga.; J. H. Owens, Roanoke Guano Co, Roanoke, Ala.; E. B. Helgeson, Magnolia Fertilizer Co., Seattle, Wash.; Elbert N. Carvel, Valliant Fertilizer Co., Laurel, Del.; J. H. Epting, The Epting Distributing Co., Leesville, S. C.; H. A. Thullberry, Haines City Fertilizer Works, Haines City, Fla.; J. E. Totman, Summers Fertilizer Co., Inc., Baltimore, Md.; James W. Dean, Knoxville Fertilizer Co., Knoxville, Tenn.; Robert S. Cope, The Reliance Fertilizer Co., Savannah, Ga.; L. E. Britton, Consolidated Rendering Co., Boston, Mass.; S. F. Elwe J. The Farmers Fertilizer Co., Columbus, Ohio; C. R. Martin, The Miami Fertilizer Co., Dayton, Ohio; M. C. Field, Meridian Fertilizer Factory, Hattiesburg, Miss.; J. A. Chucka, Eastern States Farmers' Exchange, West Springfield, Mass.; C. D. Shallenberger, Shreveport Fertilizer Works, Shreveport, La.

national food program was made by Weller Noble, chairman of the NFA board of directors in his address on Tuesday morning, November 11. In focusing attention on the importance of fertilizer materials in production, he stated that for the U. S. as a whole, about 20 percent of the crop production is attributable to the use of fertilizers. In some states, the proportion is 50 percent or more. He estimated that in the current fiscal year, 16,000,000 tons of fertilizer will be produced for use on American farms . . . an output which is over two times the average of immediate prewar years. American fertilizer production capacity is estimated to be 20,000,000 tons annually, he said, and this capacity will be used to the fullest extent in the U. S. Old plants are being expanded and new ones are being built both in older areas of consumption and in localities where large-scale use of fertilizer is newer, he reported.

The fertilizer industry must be watchful, Mr. Noble warned, lest heavy shipments of fertilizer abroad under the Marshall plan, may result in domestic shortages which in turn could open the way for legislation to put Government into the fertilizer business. "Assuming that large quantities of fertilizers are so required and that prices of farm products continue at present levels, a constant barrage of protests will certainly come from many areas at home where fertilizer orders cannot be filled," he added.

Mr. Noble reported research activities of the Association, and pointed out some of the services rendered the farmer in stimulating and carrying out fertilizer research. He reviewed the activities of the group's Plant Food Research Committee, and emphasized the importance of further studies in this field. The use of fertilizer has been increasing tremendously, he reminded his listeners, particularly in the midwest and western areas. There has also been a changing and increasing emphasis on the use of fertilizers with regard to many crops. For example, the amount of fertilizer used on wheat in the middle Atlantic states was 100,000 tons larger in 1946 than in 1942; in the east north-central area, the increase was about 170,000 tons.

Other heavy fertilizer usage was reported from Florida and the west coast fruit-growing areas which continued last year to consume about 85 percent of the fertilizer applied on fruits and nuts. This record, in view of the increased total tonnage used for this purpose, is highly significant. Fertilization of vegetables has developed materially in every region except the New England states, and usage for pastures increased 26 percent from 1942 to 1946. "If this agricultural picture continues to change, as fertilizer becomes increasingly important in our agricultural economy, the need for more and more research is obvious and our industry should continue to play a prominent part in this field," he added.

Speaking of numerous workaday phases of the fertilizer business, Mr. Noble discussed some of the factors which enter into sales. "Our entire educational practices should be studied, revised and strengthened," he said. "Too many salesmen are concerned almost entirely with the sales headaches of a highly competitive industry, mainly because of the lack of knowledge of the products they have to offer, and of the conditions under which these products will ultimately be used." He went on to point out qualifications for a fertilizer salesman, stating that all such should have a knowledge of agronomy, of soil chemistry and its relation to the chemistry of fertilizer, and they

should make a study of fertilizer placement and of signs in the plant of soil deficiencies.

In discussing new areas for service, Mr. Noble quoted figures to show that the fertilizer industry has done an outstanding job in supplying areas where use of such materials was heretofore less extensive. "In 1940, according to official figures," he said, "7,778,000 tons of commercially distributed fertilizers were used in the U. S. Of this quantity, 76 percent, or 5,893,000 tons were used in 12 states. In 1946, a total of 14,530,000 tons of fertilizers were delivered to farmers in the U. S. by commercial producers, with but about 65.5 percent or 9,508,000 tons being delivered to the principal fertilizer-consuming states. In other words, the increase in deliveries to the 12 principal fertilizer-using states in 1946 amounted to 3,615,000 tons, or 61.3 percent; whereas in other areas, the increase in deliveries in 1946 amounted to 3,137,000 tons, or 166.4 percent." It is significant to note that the tonnage shipped in 1946 to states other than the 12 mentioned, amounting to 5,022,000 tons, equals about 65 percent of the total tonnage sold in the entire U. S. in 1940!

Panel Discussion

A PANEL discussion of current research problems proved to be a highlight of the convention. Taking part in the event were eleven experts of the Association's Plant Food Research Committee. These were Dr. H. B. Siems, Swift & Co., Plant Food Div., Chicago, chairman; Weller Noble, Pacific Guano Co., Berkeley, Calif.; J. E. Culpepper, Spencer Chemical Co., Kansas City, Mo.; D. D. Long, International Minerals & Chemical Corp., Chicago; E. N. Carvel, Valliant Fertilizer Co., Laurel, Del.; J. A. Churka, Eastern States Farmers' Exchange, West Springfield, Mass.; R. H. Engle, N.F.A., Washington, D. C.; H. H. Tucker, Coke Oven, Ammonia Research Bureau, Columbus, Ohio; Leroy Donald, Allied Chemical & Dye Corp., Barrett Division, Goodman, Miss.; J. A. Nattel, Pacific Coast Borax Co., Auburn, Ala.; and H. E. Hendricks, Knoxville Fertilizer Co., Knoxville, Tenn. This phase of the convention was considered such a success that a similar panel is being planned for next year's meeting.

Education Needed

THAT the progress made by the fertilizer industry should be presented to the public in greater volume than ever before, was reiterated by L. R. Neel, editor of *Southern Agriculturist*, Nashville, Tenn. He said that there is still far too much mystery, and a lack of adequate understanding of fertilizer analyses and soil needs on the part of the average farmer. He still thinks too much in terms of tonnage rather than in pounds of plant food per ton. He should know just what a 3-9-6 fertilizer furnishes his soil, and given the price of the fertiiizer, he should be able to calculate the per pound cost to him of the actual plant food he is getting, Mr. Neel said. "Then with this knowledge before him, he is in a position to learn that a 4-12-8 mixture will furnish his soil with plant food in the same relationship as does the popular 3-9-6. When he figures the unit cost of the plant food in the lower analysis and the higher analysis material, he will at once, and for all time, learn the value of using as high analysis fertilizers as practical." He continued by stating that criticism directed toward the industry for putting too much filler in its product, will be quieted when growers generally accept the higher analysis products.

Mr. Neel emphasized the importance of adjusting the fertilizer to the land to fit different natural soils, cropping systems and farm practices. He pointed out that some crops need but one material rather than several, and that a farmer must be well informed to know what is proper in his particular case.

Anhydrous Ammonia Use

THE use of anhydrous ammonia as a source of nitrogen was discussed by Dr. W. B. Andrews, associate agronomist, Agricultural Experiment Station, State College, Mississippi. He told how anhydrous ammonia has been applied to over 200,-

(*Turn to Page* 67)

Omer J. Kelley
Discusses Irrigation Problems

Dr. W. B. Andrews
Talks on Anhydrous Ammonia

Donald Comer
Points Out Overall Problems

Blight Warning Service and LATE BLIGHT CONTROL

by

Paul R. Miller and Jessie I. Wood

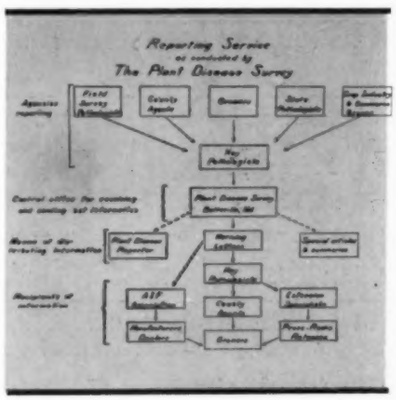
Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

LATE blight of tomatoes has attracted widespread attention and has been the cause for much alarm throughout the growing and canning industry during the past two years. That a single disease of one crop should cause such a furor may seem strange until one considers the value of the crop and the extent to which it is grown throughout the country both in home gardens and commercially cultivated areas. Its welfare affects a wide range of interests from grower to consumer. It is understandable, therefore, that there should be anxiety when the potential crop is cut in half, or more, by a disease which appears suddenly and about which little is known. What about future recurrences? What action may be taken toward the development of reliable means to prevent the blight? These questions quickly arose, and it is the purpose of this article to relate the steps which are being taken to control the disease.

Areas in this country where tomato growing is an important industry are clearly indicated in Figure 1, which shows the acreage of the commercial tomato crop in the United States. Although some shifting has taken place since the 1939 census on which it is based, the map is still generally accurate, and furnishes a good background for the following discussion of the late blight warning service and the summary of tomato blight importance in 1947.

Blight Warning Service

SEVERE outbreaks of tomato late blight, *Phytophthora infestans*, in 1946 caught many pathologists, growers, and fungicide dealers unawares. The need was evident for a specific and prompt reporting service



to prevent similar unpreparedness should another epidemic threaten.

To fill this acute need for accurate and timely seasonal information, a warning service was established in early 1947 by the Plant Disease Survey of the Bureau of Plant Industry, Soils, and Agricultural Engineering, covering the eastern half of the United States and Provinces of Canada as far west as Manitoba. As noted on the accompanying chart, the warning service operates through designated key pathologists. The key men for each state send brief reports on essential facts such as dates and places of earliest appearance, weather of past week, spread to new areas, and losses incurred. The reports are assembled by the Plant Disease Survey into a warning letter and transmitted immediately to the state key reporters who are responsible for making this information available within their respective states and for issuing control recommendations.

Copies of the reports are also sent to the Agricultural Insecticide and Fungicide Association in order to facilitate prompt distribution of the data to interested members of the industry, and thus make possible the most advantageous allocation of fungicides both as to place and time.

Late Blight in 1947

OCCURRENCE of late blight in 1947 as reported on tomato and potato in the area included in the warning service in the U. S. and Canada is shown in Figures 2 and 3, respectively. Figure 4 indicates the extent of the loss to the tomato crop as estimated this year, with more specific information as to importance and areas affected in the different states compiled in Table 1. For comparison, the losses due to last year's extraordinary outbreak are shown in Figure 5. By comparing these maps with Figure 1, one can see how differently the disease affected the important tomato-growing areas in the two years.

The reports and estimates of loss show that tomato late blight was much less widespread in 1947 and caused less loss than in 1946 (Figures 4, 5). In some regions, hot, dry

Manufacturing or Formulating	You need	SO INVESTIGATE
DDT Emulsion Concentrates?	EMULSIFIERS that make readily formed emulsions of good stability which are compatible with other insecticides and fungicides.	TRITON X-100 TRITON X-155 TRITON B-1956
DDT 50% Wettable Powder?	A WETTING AGENT and a dispersant that provides good wetting and depositing characteristics without excessive foaming; that gives outstanding dispersability and suspendability, and re-suspends readily.	TRITON X-120 plus TAMOL N
Benzene Hexachloride?	A WETTING AGENT and a dispersant that provides good wetting and depositing characteristics without excessive foaming; that gives outstanding dispersability and suspendability, and re-suspends readily. AN EMULSIFIER that makes readily formed emulsions of good stability which are compatible with other insecticides and fungicides.	TRITON X-120 plus TAMOL N TRITON X-155
Chlordane?	EMULSIFIERS that make readily formed emulsions of good stability which are compatible with other insecticides and fungicides.	TRITON X-45 TRITON X-100 TRITON X-155
Hexaethyl Tetraphosphate?	A WETTING and SPREADING AGENT that makes clear, stable concentrates which dilute to form clear solutions.	TRITON X-100 TRITON X-155
Chlorinated Camphene?	EMULSIFIERS that make readily formed emulsions of good stability which are compatible with other insecticides and fungicides. A WETTING AGENT and a dispersant that provides good wetting and depositing characteristics without excessive foaming; that gives outstanding dispersability and suspendability, and re-suspends readily.	TRITON X-100 TRITON X-120 plus TAMOL N
Wettable Sulfur?	A combined WETTING and CONDITIONING AGENT that provides good wetting and depositing characteristics without excessive foaming; that gives outstanding dispersability and suspendability, and re-suspends readily.	TRITON X-166 plus TAMOL N
Plant Sprays?	A combined EMULSIFIER, SPREADER and DEPOSIT BUILDER.	TRITON B-1956
Oil Sprays?	Internal EMULSIFIERS for the manufacture of miscible and emulsifiable oils, also suitable combinations for 83% flowable oil emulsions, stable to freezing. Formula recommended depends on oils to be used.	TRITON X-45 plus TAMOL N TRITON X-100 plus TAMOL N TRITON B-1956

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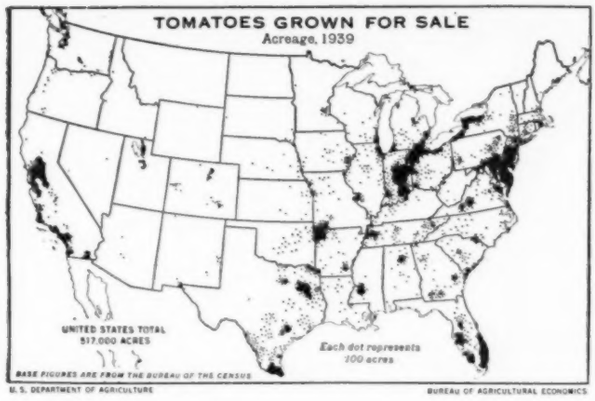

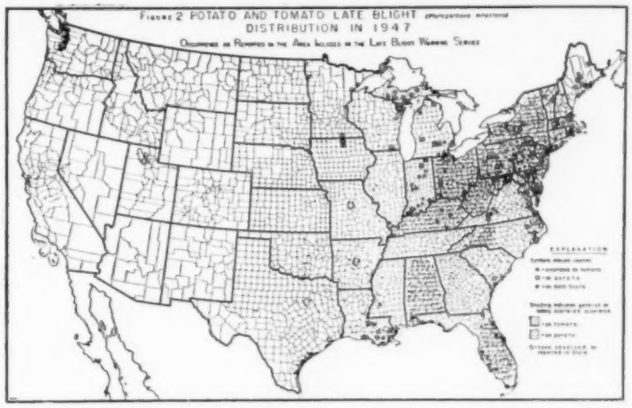

The charts shown on this page speak for themselves. Figure 1, (above) shows the areas in which tomatoes for sale are grown in the U. S. Figure 2 shows the extent of late blight in the northeastern states. Figure 3, (right) reveals how extensive the disease was in reaching into Canadian Provinces. Figures 4 and 5 (below) compare tomato losses in 1947 as compared to the preceding year. Note how greatly reduced the losses were during the past season.

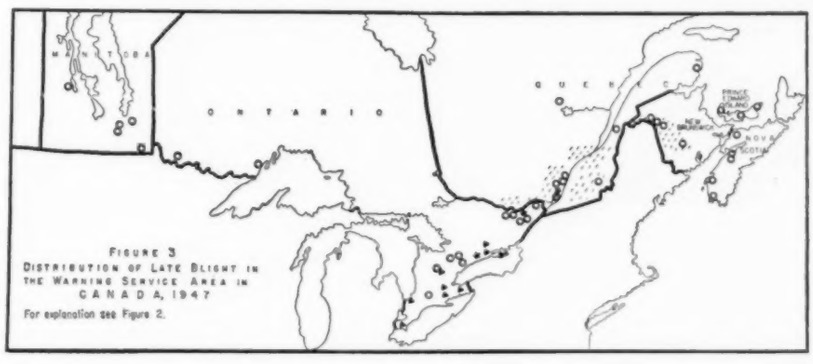

FIGURE 3
DISTRIBUTION OF LATE BLIGHT IN THE WARNING SERVICE AREA IN CANADA, 1947
For explanation see Figure 2.

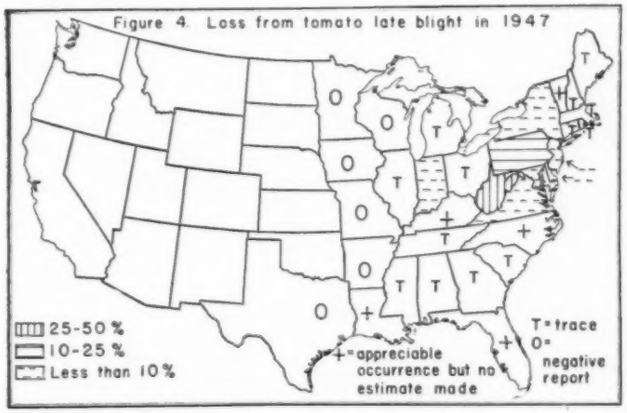
Figure 4. Loss from tomato late blight in 1947
25-50 %
10-25 %
Less than 10%
+ = appreciable occurrence but no estimate made
T = trace
0 = negative report

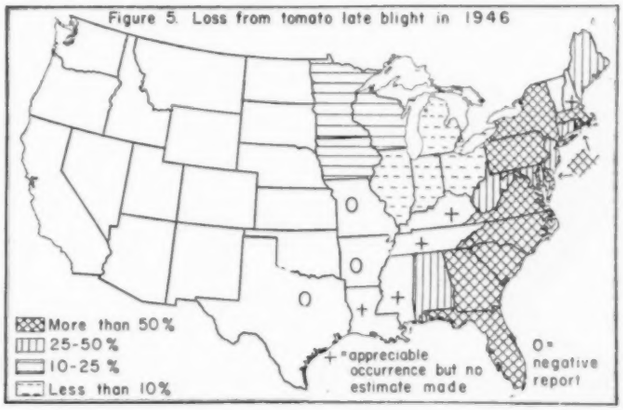
Figure 5. Loss from tomato late blight in 1946
More than 50%
25-50 %
10-25 %
Less than 10%
+ = appreciable occurrence but no estimate made
0 = negative report

weather was said to be responsible for absence or reduced amount of late blight. In other sections, control applications kept loss down although the attack of the disease was general and severe (Table 2). In some states where weather was not conducive to serious general occurrence, fungicidal treatments were believed to have been an important factor in preventing severe local outbreaks. This was notably so in Delaware, New Jersey, and Maryland (see Table 2).

The late blight season began unusually early this past season. The disease was already established in the southern East Coast region of Florida early in November. In the Everglades section very heavy rains interfered with the control program and the fall potato crop suffered heavy loss. Even under these conditions, however, good equipment, proper timing, and frequent applications of "Dithane" controlled the disease. Early in December blight appeared on potatoes and tomatoes on the West Coast, and by February it was reported in the Hastings potato-growing region of the upper East Coast. The general use of fungicides such as "Dithane-zinc-lime" and "Copper A" stopped fast spread in infected fields, although severe loss occurred in some untreated fields and plant beds.

During the second week in February, severe freezes killed practically all potato and tomato plants throughout Florida except in some West Coast areas, as well as in other Southern States. This event must

surely have been a factor in subsequent late blight development, not only in Florida but in other sections as well. It put back the progress of the disease at least a month, since infection did not reappear in replanted fields and plant beds in the northern East Coast region until the middle of March. It is easy to speculate on the relation of this setback to the absence of infection in Georgia tomato plant beds and consequent lack of transmission to northern areas with these southern-grown plants.

Aside from Florida, the area in which tomato late blight became most generally prevalent and important in 1947, was in the central Atlantic region, from New York to Delaware on the east and New York to West Virginia on the west. The area is described in this manner because occurrence in Maryland and Virginia was scattered or local. Late blight was reported in most of this region a month or so later than last year. Subsequent development varied in details in different parts of the area but in general hot dry weather during August checked the disease from southeastern Pennsylvania southward, while northward and westward August weather was more favorable and spread continued.

The year 1947 was worse for tomato blight than 1946 in New York, according to Chupp, but because of the practically universal application of sprays or dusts, even in home gardens, the resulting loss averaged only 7 to 10 pecent, as compared with 50 to 70 percent in 1946. Kirby reports that in Pennsylvania losses would have been twice as bad as the 20 percent estimated were it not for efforts made to keep the disease under control. In the central and northern parts of the state, losses in untreated fields ranged from 50 to 90 percent. In both states control obviously gained a real triumph over the disease.

In Delaware and New Jersey, the disease became widespread but was much less severe, mostly because of generally unfavorable weather after the initial spread took place. Nevertheless, fungicidal treatments in these states were believed to have been an important factor in the small loss. In Delaware, 75 percent of the acreage was treated and all of the slight damage that occurred was suffered by untreated fields. In New Jersey, general use of fungicides probably prevented serious outbreaks in many fields where local conditions were favorable.

Developments on the Delmarva peninsula were particularly interesting. The disease appeared in Worcester County on the southern Eastern Shore of Maryland in the middle of July after a short period of favorable weather. By the middle of August it was general in Worcester County. Half of the acreage was affected and 30 percent loss resulted, in spite of the fact that 70 percent of the acreage received at least one treatment and half of it was given a regular fungicidal schedule. In the upper part of the Virginia Eastern Shore in northern Accomac County, a brief but severe outbreak occurred during a favorable period for two weeks at the end of July and the beginning of August; by August 9 weather had again checked the spread of blight started July 22 and by the

TABLE 1.

Losses reported from tomato late blight in 1947.

STATE	LOSSES REPORTED
Florida	Widespread, but loss not estimated. Control used generally.
Louisiana	Slight; some loss in Plaquemines Parish.
Mississippi	25-30% one field; light infection another; only 2 fields in which disease observed.
Alabama	Not serious; scattered infection throughout.
Georgia	None observed during tomato season.
South Carolina	Negligible; very local occurrence.
North Carolina	None in eastern; present but loss not estimated mountain area.
Kentucky	No estimate made; general and destructive in home gardens on early tomatoes.
Tennessee	?
West Virginia	25-30%; mostly from central mountain area eastward.
Virginia	15-20% South-Western Virginia, up to 75-100% some cases. 3% Eastern Virginia, confined to one small area on Eastern shore.
Maryland	20% Western Maryland; 1-5% North-Central Maryland; 2% Southern Maryland; 1% Northern Eastern Shore; none in Central Eastern Shore; 30% Worcester County, none in others of Southern Eastern Shore.
Delaware	1%
Pennsylvania	20%, if not controlled would have been double. Worst Central and North where 50-90% untreated with blight. Vicinity of Philadelphia T-10% loss. Western Pennsylvania about as bad as 1946 (15-50%).
New Jersey	Much less important than 1946.
New York	7-10%; worse year for blight than 1946 but control kept loss lower.
Connecticut	No consequence.
Rhode Island	Traces, loss negligible.
Massachusetts	Trace
Vermont	No estimate; less than last year.
New Hampshire	Less than many years.
Maine	Traces.
Ohio	No estimate; small loss in staked tomato area of South-Eastern Ohio; commercial canning crop in North-Western late and early frosts killed it before late blight damage.
Indiana	Severe in restricted areas, elsewhere traces. No estimate.
Illinois	Only one field noted, disease disappeared in it later.
Michigan	Less than 1%. Only noted in 3 Counties South-Eastern Michigan.
Wisconsin	None observed on tomato.
Minnesota	None on tomato.
Iowa	None on tomato.
Missouri	No late blight observed.
Arkansas	No late blight observed.
Texas	No late blight observed.

31st the disease was general in untreated fields, but absent or scarce in treated plantings. Late blight did not appear in the southern part of the Virginia Eastern Shore, and did not become established in the central counties of the Maryland Eastern Shore.★★

TABLE 2.

Effectiveness of control against tomato late blight in 1947.

STATE	Control: materials, effectiveness, extent of use
Florida	"Dithane-zinc-lime," "Copper A," others not specified. Use very general; results good where applications thorough and according to schedule.
South Carolina	Mostly 6% fixed copper dust; few growers used "Dithane Z-78 dust." Better dust program in Charlestown and Beaufort than in 1946. Little damage even to untreated fields.
North Carolina	In mountain area some dusting small plantings reduced losses especially to fruits.
Kentucky	"Copper A" spray, or "C.O.C.S." dust saved commercial plantings of early crop when used. "Cuprocide" dust not effective. Disease destructive in untreated home gardens on early tomatoes.
West Virginia	Copper in bordeaux or fixed form mostly used. Many growers have not realized importance of fungicide.
Southwestern Virginia	Spraying and dusting considerably increased from last year; however disease less severe even where no control measures were used.
Eastern Virginia	Some spraying, 2 to 5 applications, did not affect outbreak in Eastern Shore area because stopped too soon.
Maryland	Fixed copper compounds most widely used: some "Dithane" and some "Zerlate;" dusts more than sprays. Regular treatment program seemed better than occasional applications timed on basis of weather. Control good. More treatment than last year, about half on average of acreage received regular program; even more treated at least once. Some use of air dusting, in 2 northern Eastern Shore counties this method used more than ground dusting.
Delaware	About 75% of acreage treated, all of loss from late blight in untreated fields. Fruit infection in untreated fields increased in spite of unfavorable August weather.
Pennsylvania	Copper fungicides recommended; dusting less effective than spraying. At least 25 tomato spray rings operated. Loss would have been double without control.
New Jersey	Much more copper and other fungicides used than last year. Weather greatest factor but general use treatment probably prevented serious local attacks.
New York	Copper sprays or dusts used. Hardly gardener who did not make some applications. Even one did some good; with 5 or 6 applications crop almost free of rot. Spray rings organized; airplanes used in a few instances. Season more favorable even than last year when loss was 50% or more, but control reduced loss this year to average of 7-10%.
Vermont	Easily controlled in fields sprayed or dusted before July 23; heavy loss in unsprayed.
Ohio	Crop so late that fungicides not used many fields, but about 10% of commercial growers used control measures: spraying, ground dusting and airplane dusting. In experimental plots recommended schedules good control, while 75% plants killed in untreated checks.
Michigan	About 700 acres dusted twice from air with "Dithane," no late blight in these fields although some in area.

N. E. Phytopaths Elect Dr. O. C. Boyd President

Dr. O. C. Boyd, extension plant pathologist, Massachusetts state college, Amherst, was elected president of the North-Eastern Division of the American Phytopathological Society at the group's second annual meeting at Poughkeepsie, N. Y., November 25 and 26. Dr. Boyd succeeds Dr. S. E. A. McCallan, Boyce Thompson Institute, Yonkers, N. Y., who was elected counsellor for the national society. Other officers elected were Dr. P. H. Palmiter, N. Y. State Agricultural Experiment Station, Poughkeepsie, vice-president; and Dr. L. M. Black, Brooklyn Botanical Gardens, New York, secretary-treasurer. The former secretary-treasurer was Dr. W. T. Schroeder of N. Y. State Agicultural Experiment Station, Geneva, and the former vice-president was Dr. M. T, Hilborn, Agricultural Experiment Station, Orono, Maine.

The meeting consisted of round table discussions, business meeting, and the presentation of a number of papers on current plant disease problems. A paper prepared by Drs. A. E. Dimond and E. M. Stoddard, both of Connecticut Agricultural Experiment Station, New Haven, on chemotherapeutic activity was presented by Dr. Dimond. The study of chemotherapeutics is progressing, the paper reported, with common blight of bean as a screen for testing new materials.

Turf diseases and their control were discussed by Drs. F. L. Howard and H. W. Thurston of Rhode Island Agricultural Experiment Station, Kingston. New fungicides for control of dollar spot and other grass diseases were discusesd. Dr. J. M. Hamilton, Geneva, reported results to date on cooperative fungicide tests for the control of apple diseases. He stated that the cooperation of various persons around the country was gratifying and effective toward making progress in fact-finding.

Further discussions were held on potato top killing and discoloration of tubers, methods of diagnosis, and field and laboratory experiments for plant disease control.

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New C. S. Board Chairman

Commercial Solvents Corp., New York, has announced the appointment of Maj. Theodore P. Walker as chairman of the board, and the election of Henry E. Perry as president of the corporation. Maj. Walker was formerly president, and was succeeded by Mr. Perry in that position.

•

Davies Given Navy Award

Paul L. Davies, president of Food Machinery Corporation, San Jose, Calif., was recently awarded the Certificate of Merit by the U. S. Navy Department. The award was granted in recognition of the corporation's wartime production of tracked amphibian vehicles.

SUBJECT: Weed control in Barley and Rice

AREA: California and Nevada

FIELD NOTES of a DuPont Service Man

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DU PONT PEST CONTROL PRODUCTS

The Listening Post

Insect Conditions During Late Fall of 1947

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

THE Mexican bean beetle has remained active this year in the deep South for about eight months. Infestations continued moderate to heavy in parts of South Carolina, Georgia, and Florida during the last half of October, but diminished in intensity even in those areas during early November.

The bean leaf roller was present in moderate numbers on the bean crop in Florida and Georgia during the last half of October. The infestations were reported as serious in some parts of Florida during early November on beans not treated with insecticides.

Late in October the lesser cornstalk borer was prevalent on beans in Manatee County, Florida and was also causing considerable damage to young bean plants in the Lower Rio Grande Valley of Texas. Light populations of the banded cucumber beetle were still present on beans in Florida and Georgia by the middle of November.

Cabbage caterpillar populations showed a general increase in southern districts toward the end of October. Infestations were moderate to heavy on cabbage and related crops in parts of South Carolina, Georgia, Alabama, Mississippi, the Lower Rio Grande Valley of Texas, and in southern Arizona. Infestations of similar intensity were also reported in early November from parts of Louisiana and the Gulf Coast district of Texas, while infestations appeared to be somewhat lighter in Florida and southern California.

The harlequin bug was still numerous on crucifers in Alabama in mid-October. Populations of this insect decreased sharply throughout its range shortly thereafter, although it was still infesting cruciferous crops in Maryland, Georgia, Florida, Alabama, and Mississippi toward the end of that month and persisted into early November in some areas, including Florida and Alabama.

There was an outbreak of cutworms in the Zellwood district of Florida early in November, serious damage being caused to considerable acreages of romaine, lettuce, and escarole. This outbreak had practically ceased by the middle of the month due to the application of control measures and pupation of the insects. Light infestations of these pests also occurred in early November on several vegetable crops in the Belle Glade district of Florida and they were reported as very numerous and causing serious damage to shallots at Baton Rouge, Louisiana.

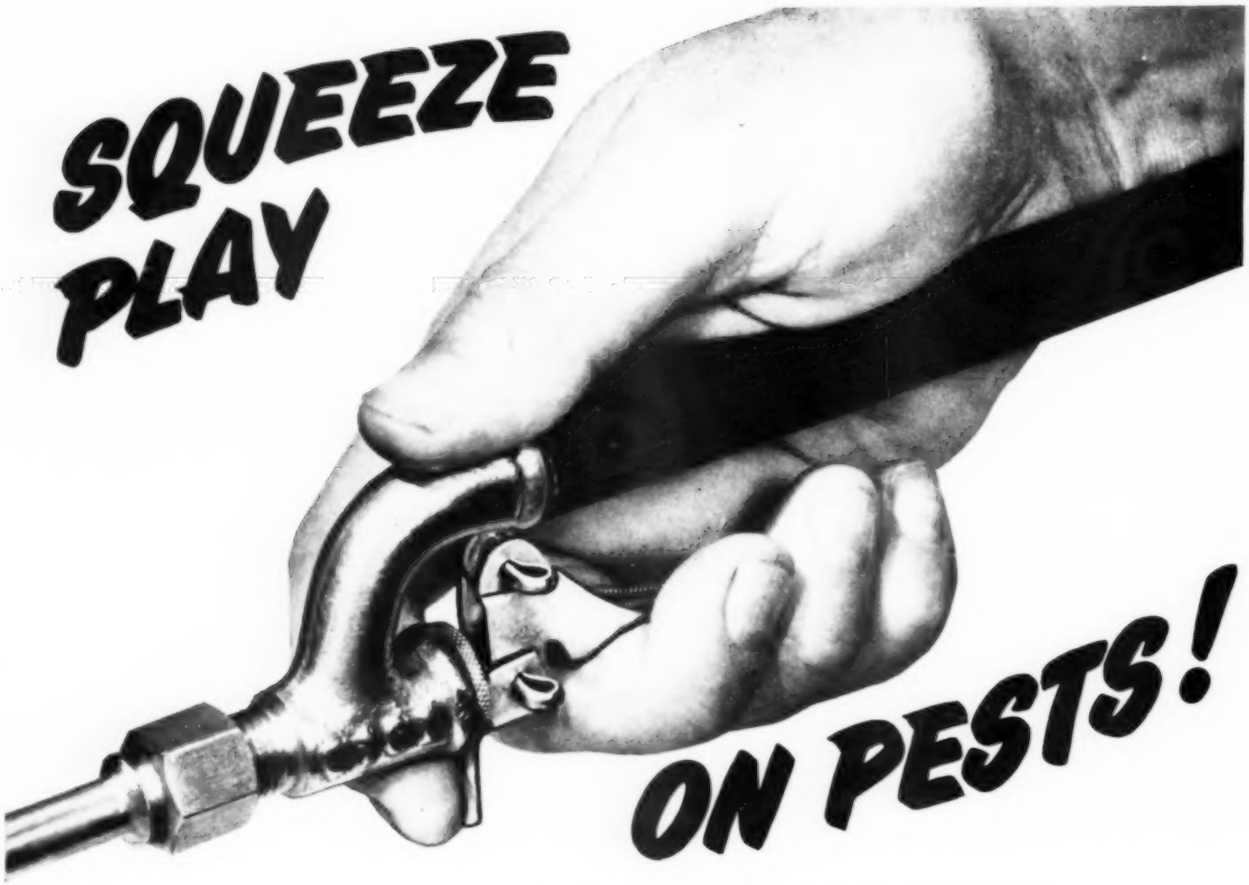
The potato tuberworm caused serious damage to stored potatoes in Dinwiddie County, Virginia early in November. This insect was also abundant at that time on late potato and experimental tobacco plantings in Gadsen County, Florida.

Along with the general seasonal lowering of temperatures, aphids were reported as becoming more numerous on cruciferous crops in most southern areas during the last half of October. These included the turnip aphid in South Carolina and Louisiana, moderate infestations of the cabbage aphid on cauliflower in southern California, moderate to heavy infestations of aphids on crucifers in parts of Alabama and Mississippi, and a general increase of aphids on various vegetable crops in Florida. During the first half of November the turnip aphid was present quite generally on crucifers in southern districts, the infestation being moderate in Alabama and heavy in Louisiana. This insect was also present at that time on turnips and cabbage in the Gulf Coast district of Texas. By early November the cabbage aphid was present in all fields of cabbage and cauliflower in southern California, but populations were kept at a low level by effective insecticide treatments.

Reports now available indicate that the gypsy moth caused defoliation to only 7,422 acres during the summer of 1947. This is the smallest amount of defoliation of woodland trees by this insect recorded since 1925. Most of this occurred in Massachusetts, and was most severe in a few towns in Bristol, Plymouth, and Barnstable Counties. Only a small amount occurred in New Hampshire and no defoliation was reported from Maine, Vermont, Connecticut, Rhode Island, New York or Pennsylvania. Approximately 255 square miles of infested area were treated for control of the gypsy moth this year. This included a total of 163,659 acres sprayed with DDT in Connecticut, Massachusetts, New Hampshire, New York, Pennsylvania, and Vermont. Of these, 106,737 acres were treated by means of aircraft, 54,733 acres with blower type equipment, and 2,189 acres with knapsack equipment. More than half the area has been surveyed since the end of the treating season and the results thus far have failed to disclose any egg masses in areas treated with aircraft.

The application of DDT sprays from airplanes to 413,469 acres of forest in mountainous country in Idaho, Oregon, and Washington this past summer is now reported as having been a complete success in bringing under control a severe outbreak of the Douglas fir tussock moth.

SQUEEZE PLAY ON PESTS!



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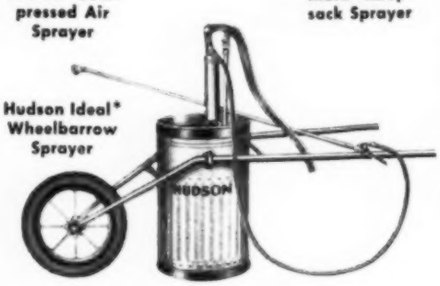

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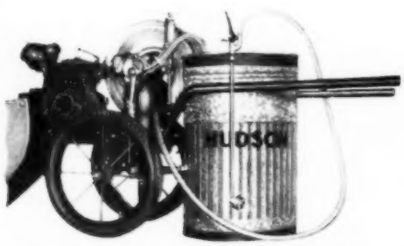

Hudson Defender* Power-Operated Sprayer

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The Bureau of Entomology and Plant Quarantine and the Forest Service of the U. S. Department of Agriculture, in cooperation with the affected states and with private timber owners, applied 390,881 gallons of DDT solution to the most heavily infested timber during the period May 22 to July 2. This involved a total of 2,120 flights by small planes as well as large ones of the C-47 and Ford Tri-motor type. The spraying was done while the caterpillars were small and before they had caused much defoliation. It was almost impossible to find living caterpillars in the treated areas a few days after the spray was applied. Much of the timber already weakened by defoliation in 1946 would have been killed had steps not been taken to prevent defoliation in 1947. This included some 1,518,000,000 board feet of commercial timber in Idaho alone with stumpage value of $4,625,000. Surveys are being made to determine if isolated areas remain where spraying may be necessary in 1948.★★

Unusual Plant Disease Occurences of 1947 Season

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

WORKERS of the University of West Virginia report that near the end of the sour cherry harvest in 1947, a cherry fruit rot of unusual appearance was observed in Jefferson County, West Virginia. On certain trees a considerable number of fruits were affected and on some large branches almost all of the fruits were rotted.

The stage of development of the rot varied from fruits that had decayed and almost completely dried, to fruits with spots so small as to be barely detectable. The tendency of the recently infected fruits to be grouped around or beneath fruits with older lesions was noticeable.

Examination of other orchards in which harvest had not been completed, revealed the presence of this rot in appreciable amount. A few similarly infected fruits were found in all orchards visited but the amounts were negligible in most. The two orchards in which highest incidence of the disease was found were closely planted on low ground and had poor air drainage. Within these orchards the rot was more abundant where the poorest air drainage was. On higher ground and on smaller trees, very little of the disease occurred. Counts based on the total crop from several trees selected as being heavily affected in the orchard where the disease was first found, averaged from 11 to 15 percent of the fruits infected. The total tonnage lost was not great; however, the rigid sorting necessitated by the presence of the rot greatly increased the harvest labor cost.

Starting as a small tan-colored, scalded spot, not unlike the first symptoms of brown rot, the rot progressed and developed concentric folds until it reached the greatest diameter of the fruit. At this point the advance usually ceased and the rotted area became dry and hardened. The diseased tissue yielded a fungus resembling *Glomerella cingulata*, the cause of bitter rot of apple. By cross inoculations it was proved that this disease of sour cherry was caused by the same organism that causes bitter rot of apple.

No data were obtained on the control of this disease other than the fact that applications of fixed copper sprays at the rate of three-fourths pound of metallic copper per 100 gallons obviously did not offer adequate protection. So far as is known this is the first occurrence of this disease in commercial orchards.

Cotton Canker in Georgia

CAUSED by *Ascochyta gossypii*, "wet weather canker" was wide-spread and destructive on cotton in Georgia during the last week of June. The leaf spot phase was present on almost 100 percent of the plants. A large percentage showed stem cankers and approximately 10 percent of the plants were killed or injured beyond recovery. Specimens were received from 8 counties and the disease was found active in every cotton field visited. Later reports indicated that it was prevalent throughout the northern half of the State. Apparently a long period of time in which high humidity prevailed was a contributing factor to this outbreak.

This is the first outbreak in seven years, and the fourth time the disease has been recorded as causing damage in this State. Previous incidences occurred in 1915, 1922, and 1940. The damage produced in 1947 appeared to be more severe than in any previous year, because small plants lacked the ability to recover and put on new growth. Owing to the cool rainy weather during April and May, cotton was planted two to three weeks later than normal and continued cool weather caused the plants to be damaged severely by flea hoppers, thrips and other insects. In some fields the plants were but 6 to 8 inches tall when attacked. In such fields the fungus frequently entered and killed the stem at the first node. There was some indication of differences in susceptibility among varieties but the data available in this respect are not conclusive.

Yellow Bean Mosaic

ACCORDING to H. Loran Blood all but 75 of 240 acres of Blue Lake pole beans planted for canning in the Cache Valley of Northern Utah have been abandoned because of an unusually heavy infection of both common bean mosaic (green type) and yellow bean mosaic. The common bean mosaic is distrib-

(*Turn to Page 67*)

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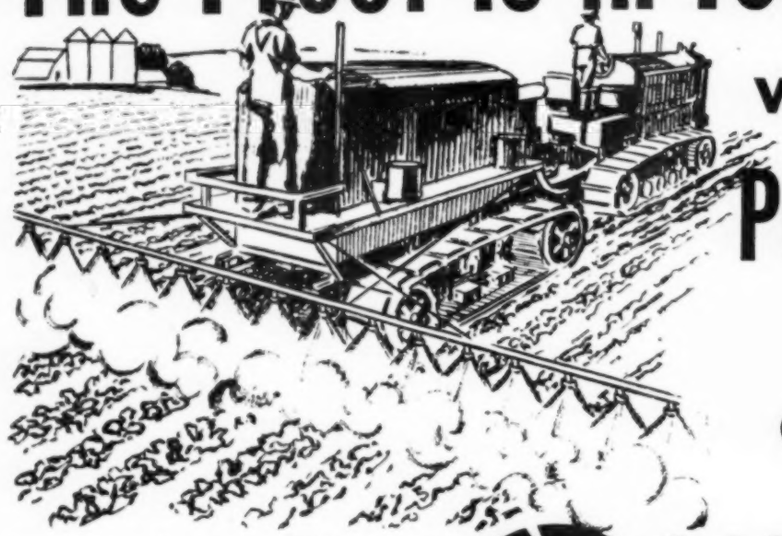

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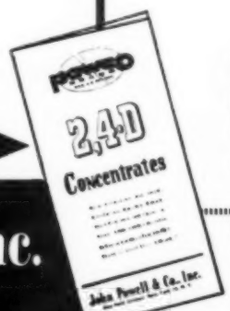

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Technical Briefs

Cattle Dips Successful

Field experiments in Queensland showed good control of cattle tick with dips charged with 0.5 percent of DDT in a water-miscible preparation called "Rucide." No irritation or scalding appeared to result. Residual activity lasted between one and two weeks, during which time the cattle appeared to act as poisoned baits, clearing the pastures of larval ticks. The advantages and relative costs of DDT dips as against arsenical dips are discussed. L. F. Hitchcock and I. M. Mackerras, *J. Council Sci. Ind. Research 20,* 43-55 (1947).

•

2,4-D vs Dandelion

A single treatment with 0.1 percent 2, 4-D was effective in eradicating narrow leaved plantain and two species of broad-leaved plantains with little or no recovery up to April of the following spring. *Plantago rugelii,* the predominating species in the region of Yonkers, N. Y., was more resistant than *P. major.*

The above-ground parts of dandelion were readily killed with a single application of 2, 4-D, as in the case of plantains, but recovery responses occurred in most dandelion plots the same year and persisted through the spring of the following year. Recovery responses included new seedlings and rejuvenated rosettes arising from the roots of older plants not entirely killed by the spray treatment.

Although different 2,4-D treatments varied with respect to the rate of killing above-ground parts of dandelions, recovery responses were not influenced by the following factors: concentration in the range of 0.05 to 1.0 percent, rate of applying in the range 1 gal. per 90 to 180 sq. ft., respraying one to three weeks after the initial treatment as compared with a single application, and time of applying the spray.

Treatments applied in July were as effective or more effective for killing the tops of dandelions and also for minimizing recovery, as the sprays applied in May, June, or September. These results are not in agreement with the prevalent conception that dandelions are eradicated more effectively when treated in the spring and fall than when treated in midsummer.

Considering the nature of recovery responses in treated dandelion plots the same year and the following spring, at least one application of 2, 4-D a year should be made on lawns in the spring or fall, preferably at both times, when top dressing and seeding are most feasible.

The ineffectiveness of 2, 4-D for killing the tops of dandelion in a wet, poorly drained lawn, indicates that soil conditions may be an important limiting factor for the effectiveness of 2, 4-D in killing other species. —*Contributions from Boyce Thompson Institute,* Vol. 14, No. 9.

•

Control Peach Leaf Curl

Recent tests of sprays to control peach leaf curl have shown that lime-sulfur and the new "Dinitro" materials were most effective. Although bordeaux mixture has given satisfactory control in the past, sprays applied last fall and spring did not stop the disease this summer. Apparently, it is effective if the trees are vigorous and sprayed regularly.

Liquid lime-sulfur at a strength of 6½ gallons to 100 gallons of water is the most effective spray tested, according to Dr. J. M. Hamilton of the Geneva, N. Y. Experiment Station, who conducted the work. Dinitro materials were found to be unusually effective if the sprays are to be applied in the spring. At this time, "Elgetol" or "Krenite" should be used at 2 quarts to the 100 gallons and the "DN Dry Mix" at 1 pound to the 100 gallons. These concentrations must be doubled if put on in the fall. It is suggested that one of the insoluble coppers or a dry bordeaux be applied just before growth begins in the spring if it is not possible to obtain one of the above materials.

•

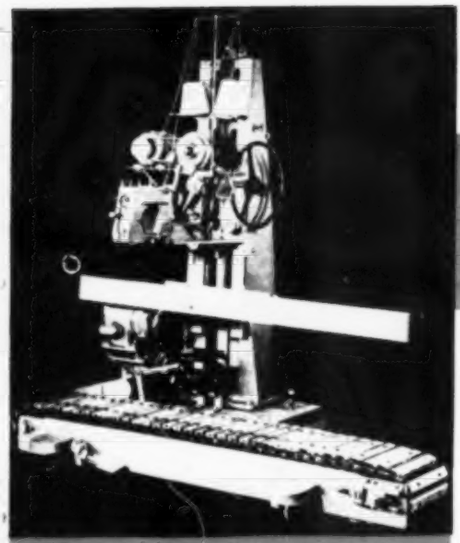
2,4-D in New Zealand

The New Zealand Journal of Agriculture for October, reports severe injury to tomato plants by use of 2,4-D. In November, 1946, curious distorted foliage appeared throughout an early crop of tomatoes in a heated glasshouse near Hastings, the story says, and plant pathologists at first thought the trouble was a virus disease. However, tests proved that the weed-killer had caused the distortion.

The article, written by J. D. Atkinson, plant physiologist, plant diseases division, Department of Scientific and Industrial Research of New Zealand, continues:

"Symptoms of 2, 4-D injury on tomatoes are as follows: When a spray of weedkilling strength (1:100) reaches a plant the main plant starts to droop within a few hours. Translucent spots develop on some leaflets, and these soon die. Brown necrotic blisters appear on the stem. Leaf stalks curl downward, while leaflet edges roll up. Twenty-four hours after treatment the plants are markedly twisted and beginning to wilt. Nine days later they are dead.

"At greater dilutions the effect of 2, 4-D is less drastic. With a dosage of 1:100,000 the only symptom shown by fully-developed leaves is a slight drooping which disappears within a few days. Stem tips start to twist spirally soon after the spray reaches them. Growth does not stop, but a permanent bend forms at this point. New foliage developing after treatment shows a pronounced narrowing of the leaflets, which are often less than a third normal width, though only slightly reduced in length. Enlarged leaf veins stand out prominently against the darker green of affected foliage, being made still more conspicuous by the fact that they often run parallel to the midrib. Thin, misshapen lobes are usually present along leaf edges and the end of the



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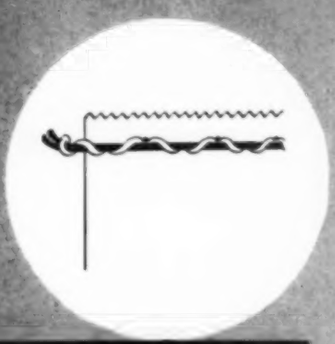

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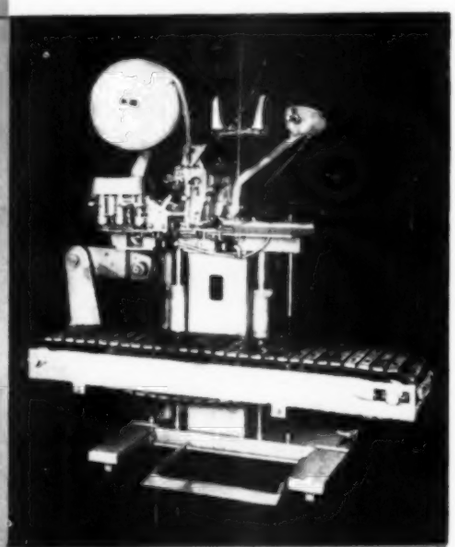

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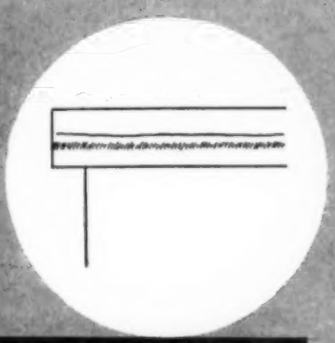

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leaf becomes a long twisted point. At this dosage narrow foliage is produced throughout the remaining life of the plant. If fruit forms, it is generally elongated, beaked, and seedless, and may have internal cavities. The whole plant appears spindly and unthrifty and is useless commercially.

"Where only a trace of 2, 4-D reaches tomato plants the immediate reaction is a slight twisting of the main stem and drooping of some leaves. These effects soon disappear, but typical narrowing and distortion appears in the next two or three leaves formed. If the dosage has been very low (1:1,000,000 or less), later leaves may develop normally, while some normal fruit may form on the upper trusses."

•

Reduces Sulfur Burn

Dr. F. M. Turrell, assistant plant physiologist in the University of California Citrus Experiment Station, Riverside, California, says rapid progress is being made in improving sulfur compounds so that sulfur burn of foliage or fruit may be reduced or eliminated.

Control of evaporation of the sulfur insecticides is being sought. Soon sulfurs having specified evaporation rates may be recommended for use in climates of different or changing temperatures, he indicates.

•

2, 4-D on Strawberries

Small weeds in strawberry beds can be eliminated by 2,4-D spray, research conducted at Michigan State College and Chatham Agricultural Experiment Station has shown. The spray was applied at half strength when the weeds were as much as two or three inches tall. Although strong enough to destroy weeds, the spray did not injure the strawberry plants. Strawberry plants are fairly resistant to low concentrations of 2,4-D, with some varieties more resistant than others. The new Robinson, now widely grown in Michigan, is more resistant than the older species, Premier.

Timing of the spray application is important, since the young flower buds and flowers on strawberry plants are sensitive to 2,4-D. Therefore, the second-year or fruiting bed should not be sprayed until after harvest. The first-year bed may safely be sprayed at any time since no crop is harvested during that year.

•

Rotenone Synergists

Effective results are reported from tests with rotenone and piperonyl butoxide against Mexican bean beetles on beans. The results have demonstrated a definite synergism between rotenone and the piperonyls. Using 0.125 percent rotenone and 0.5 percent of the piperonyl, control was obtained of high populations of the beetles, and some high yields of beans were reported equal to that obtained with 0.5 percent rotenone plus 3 percent DDT. These findings indicate that either piperonyl cyclonene (formerly known as piperonyl cyclohexenone) or piperonyl butoxide can be used effectively against bean beetles with small amounts of rotenone, and that such combinations may give similar control for different kinds of insects that attack agricultural crops. Of significant importance is the fact that these ingredients offer no hazards when used on garden crops or on other produce to be used for food or for feed.

—From report of experiments conducted by Lloyd W. Brannon, U.S.D.A., Norfolk, Va.

•

BHC on Peach Curculio

Reducing the number of curculio-wormy dropped peaches has been accomplished very effectively during the past season in New Jersey. Field tests made under conditions where the plum curculio produces but one generation annually indicate that two or three applications of various benzene hexachloride spray powders, used with wettable sulfur at dosages approximately equivalent to 2 pounds per 100 gallons of a product containing 6% of the gamma isomer of BHC, are more effective than the same number of applications of acid lead arsenate used at the same dosage, with wettable sulfur and hydrated lime and with or without zinc sulfate. At these and 50% greater dosages the various BHC powders had little apparent effect on adult curculios under field conditions and apparently accomplished the reductions in wormy drops largely by killing the immature stages (most likely the larvae, but possibly also the eggs) in the fruits.

There were appreciable differences in efficiency, in reducing curculio reproduction, among the several brands of BHC spray powders tested, apparently owing largely to differences in gamma isomer content and particle size. Evidence was obtained that the efficiency of BHC powders in this use is not appreciably reduced by using them with zinc sulfate and hydrated lime and that it may be approximately doubled by using them with an efficient spray coverage supplement.

The effectiveness of a BHC spray program against plum curculio on peaches is importantly influenced by dosage, interval between sprays, and period covered by the program of sprays. According to best available present indications, thorough application of a BHC spray powder containing 6% of the gamma isomer of BHC at a dosage of 2 pounds per 100 gallons (or its equivalent) at weekly intervals, or 3 pounds per 100 gallons (or its equivalent) at 10 day intervals, beginning with the shuck split spray and continuing through the period of the main curculio attack, will reduce curculio reproduction and the population upwards of 95% if done not later than 6 weeks before harvest. It appears likely that use of half the above dosages will still result in a greater reduction in larval injury than can be obtained with lead arsenate as commonly used.

Use of BHC in these tests had no observed effect on the fruit at harvest (first week in August) regarding either taste or odor, nor as regards incidence of brown rot, Oriental fruit moth, or bacterial spot injury.★★

—Summary of paper presented at Eastern Branch Meeting, A.A.E.E., Philadelphia, Nov. 21, 1947, by Dr. B. F. Driggers, New Brunswick, N. J.

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Attagenus piceus
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Off the Record...

This new column, "Off the Record," is to appear in subsequent issues of AGRICULTURAL CHEMICALS. *In it we hope to bring you tidbits of less formal nature than would ordinarily appear in the news columns.* —EDITOR.

POSSIBILITY of the A.I.F.A.'s holding its annual spring meeting in February appeared to be gaining ground as we went to press late in November. Place of such a gathering is likely to be Washington, D. C. instead of at Rye, N. Y., the usual locale for the meeting which is ordinarily held late in April. Note: this is only a *possibility*.

•

Community-wide rat extermination drives are becoming popular in many rural sections as a means for conserving wheat and other grains now in critical supply. Congressman Arnold of Missouri has proposed a "Rat Killing Week," while Farm Bureau organizations have already organized campaigns in their localities with the rallying cry "Clean out all the rats." Cooperatives are lending their help by promoting sales of rat baits, including "Antu" and red squill.

Suggestive of the commonly reported situation on many farms is a report from one farm group which had presented the rat problem on a local radio program. After hearing the broadcast, one farmer began a control program on the pests on his farm, and soon had 200 dead rats to show for his efforts.

A request was sent to the House Appropriations Committee on November 17, to investigate fully the domestic shortage of nitrogen fertilizers before Congress votes emergency aid to Europe. The request came from Representative Jamie L. Whitten of Mississippi, who pointed out that a shortage of tank cars is largely responsible for the lack of capacity production in many plants. He asked for a full study of production and distribution of fertilizer in the U. S.

The committee's chief investigator stated that before an investigation is ordered by the Appropriations committee, a majority of its members must approve the proposal. This committee, he said, investigates only the activities of Government agencies, which observers took to mean that Mr. Whitten had submitted his request to the wrong committee for such an investigation.

•

Dr. Alvin J. Cox, member of AGRICULTURAL CHEMICALS editorial advisory board, and a frequent contributor to its pages, is author of "History of Fertilizer in California" which appeared in the recent 70th anniversary issue of *California Cultivator*.

Application Group Meets

The National Joint Committee on Fertilizer Application was scheduled to meet at the Stevens Hotel, Chicago, on December 15. The preliminary program included talks on soil fertility and plant breeding in relation to fertilizer application by Dr. Firmen E. Bear, New Jersey Agricultural Experiment Station, New Brunswick; Dr. G. B. Siems, Swift & Co., Chicago; Dr. F. H. Hull, Florida Agricultural Experiment Station; and W. A. Roberts, former chairman of the Farm Equipment Institute. Papers on "Radioactive Applications to Fertilizer" were scheduled to be given by Vincent Sauchelli, Davison Chemical Corp., Baltimore; Dr. W. L. Nelson, North Carolina Agricultural Experiment Station; and a member of the Atomic Energy Commission. Dr. G. N. Hoffer, American Potash Institute; Dr. W. B. Andrews, Mississippi Agricultural Experiment Station; Dr. N. J. Volk, Indiana Agricultural Experiment Station; and Frank G. Steward, Shell Chemical Corp., were scheduled to discuss "Special Fertilizer Placement Problems" at the meeting.

•

S.E. Cotton Conference

The Southeastern Cotton Insect Control Conference was scheduled to be held December 8 and 9 at Columbia, South Carolina. The meeting was to include the states of Virginia, North Carolina, South Carolina, Georgia, Alabama and Florida. Agricultural extension service workers, agricultural experiment station personnel, insecticide equipment manufacturers and vocational agricultural workers were among those invited to attend.

Objectives of the conference included the launching of an intensified coordinated cotton insect control program for 1948; creation of an awareness on the part of growers, of cotton loss due to insects; presentation of the latest research findings; and furnishing information for the adequate distribution of insecticides. Chairman of the meeting was Robert R. Coker, member of the National advisory commission for the Research and Marketing Act of 1946, and advisor to the Board of Directors of the National Cotton Council.

Among those scheduled for appearance on the program was Dr. P. N. Annand, chief, Bureau of Entomology and Plant Quarantine, U.S.D.A., Washington; H. L. Wingate, vice-president of the National Cotton Council, and president of the Georgia Farm Bureau; Lea S. Hitchner, executive secretary of the A.I.F.A.; and Jack Vernon, vice-president of Niagara Sprayer Division of Food Machinery Corp. A panel discussion was scheduled for the final afternoon of the meeting.

•

C. D. Dickey Dies

C. D. Dickey, Sulfur Division of Southern Acid and Sulphur Co., St. Louis, Mo., died suddenly following a heart attack at Houston, Texas, November 11.

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Suppliers' Bulletins

Magnesium Booklet

An informative booklet, "Magnesium . . An Essential Plant Food Element" has been recently prepared by David D. Long, chief, feed and fertilizer research, International Minerals & Chemical Corp., Chicago. In his foreword, Mr. Long states that this booklet is presented to provide farmers with some basic facts about magnesium and to report on the results of the practical experience of farmers and research work on the function and benefits of magnesium.

Chapters include a description of magnesium as an essential plant food element; as the basic element of green coloring matter in plants; why it is so necessary to present-day crop production; its relation to other members of the plant food family; and interrelations of magnesium and potassium in production of crops.

•

Laboratory Directory

The National Bureau of Standards, Washington, offers Miscellaneous Publication M187, a directory of commercial and college laboratories. The directory contains a complete listing of commercial and university testing and research laboratories throughout the country. Information is given concerning 220 commercial labs with 80 branches or offices, and 189 college labs used for research and testing as well as instruction. Listings are arranged both geographically and alphabetically to facilitate finding. Price of the directory is 30 cents a copy. Address the Superintendent of Documents, Washington 25, D. C.

•

Publishes 38th Yearbook

International Minerals & Chemical Corp., Chicago, has recently published its 38th annual report, for the year 1947. Net sales were listed at $41,302,250 for the year, as compared to $34,373,106 for 1946. The 1947 figure was nearly double that of 1943.

Its plant food division reported the building of two sulfuric acid plants; one at Spartanburg, S. C. and the other at Lockland, Ohio. A new mixing plant at Pensacola, Fla., and an acidulating plant for manufacturing superphosphate at Mason City, Iowa, are now in operation, the report states.

•

Chlordane Bulletin

Julius Hyman & Co., Denver, Colo., has issued its General Circular 101, presenting "brief facts" about Chlordane. Its effectiveness, physical characteristics, and general description are treated in the folder. They are available from the Hyman Company.

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Weed Killer Booklet

Circular 137, *General Contact Weed-Killers,* written by A. S. Crafts, botany professor in the University of California College of Agriculture, Davis, is available free from the College of Agriculture, Berkeley 4. About 25 sprays are described, which includes all three kinds of general-contact herbicides.

•

"Bromofume" Booklets Out

Eston Chemicals, Inc., 3100 E. 26th St., Los Angeles, offers booklets on its product "Bromofume," an ethylene dibromide soil fumigant for use in the control of wireworms and certain nematodes. The booklet gives complete information on use and application of the material, with emphasis on various types of application studied in the field during the 1947 season.

•

U. S.-Philippine Report

The U. S. Department of Agriculture has recently published a report of the Philippine-United States Agricultural Mission in which is discussed education, immediate problems facing growers in the islands, and factors affecting agricultural production. A summary of recommendations is given, covering the entire field of agriculture in the islands. The booklet was published by the office of Foreign Agricultural Relations of the U. S. D. A., Washington.

•

Blaw-Knox Bulletin

Blaw-Knox Co. has issued Bulletin #2204 illustrating its products for use in the process industries. Applications reviewed in the booklet include organic synthesis, oil and fat hydrogenation, high pressure processing and solvent recovery. The bulletin is available from the company, Pittsburgh, Pa.

•

Pyrophyllite Pamphlet

Carolina Pyrophllite Co., 10 E. 40th St., New York 16, has issued a pamphlet describing its product, its uses, and its physical properties. This literature is available upon request.

•

"Tetron" Literature

Eston Chemicals, Inc., 3100 E. 26th St., Los Angeles 23, Calif., has announced the availability of its new organic phosphate insecticide, "Tetron." The product is available in three concentrations: "Tetron 100," straight chemical; "Tetron 50," 50 percent straight chemical, and 50 percent solvent and emulsifier, and, "Tetron 25," 25 percent straight chemical and 75 percent solvent and emulsifier. Technical information is offered by the manufacturers.

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Sturtevant Catalog

Sturtevant Mill Co., Boston, Mass., has published a catalog describing its complete line of crushers, mills, rotary mixers, laboratory machines, air separators and vibrating screens. Copies of the booklet may be obtained from the company, Harrison Square, Boston.

•

St. Regis Booklet

St. Regis Paper Co., 230 Park Ave., New York, has recently issued a folder, "Case History No. 19" describing its dust reducing system of bagging. The operations described in the folder are carried on by New Jersey Pulverizing Co., Pinewald, N. J.

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Frianite M3x is the product which you read about when a dust carrier is chosen to make an insecticide better. Reference lists on request.

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INDUSTRY NEWS

AAEE, APS to Discuss New Materials

THE American Association of Economic Entomologists and the American Phytopathological Society are scheduled to meet separately in Chicago late this month. The A.A.E.E. sessions are from December 27 to December 30; while the A.P.S. meeting starts December 28 and will continue through the 30th. The meetings will be held at the Congress and Stevens hotels, respectively.

The A.A.E.E. has more than a hundred papers for presentation, covering the entire insecticide field from the standpoints of industry leaders, government men, and experiment station personnel. Three symposia are planned. The first, to be held Monday morning under the chairmanship of Dr. F. C. Bishopp, U.S.D.A., is to cover the toxicity of insecticides to plants and animals other than man. The second such session, to be held Tuesday morning, will discuss chemical control practices in relation to biological control. This session, under the chairmanship of C. P. Clausen, U.S.D.A., will cover the broad aspects of the subject.

A third discussion is under the direction of S. A. Rohwer of the U. S. Dept. of Agriculture. This will deal with problems in connection with airplane application methods, rather than the technical side of insecticidal action. The annual banquet is scheduled to be held on Sunday evening, December 28, at the Congress.

The A.P.S. meeting at the Stevens also features a number of discussion periods in addition to the more than 100 papers scheduled for presentation. The colloquium on December 29, and several symposia on fungicide topics are expected to attract the interest of many. The colloquium, divided into two general sections, is to report fungicide trials on potatoes, apples, stone fruit, tomatoes and cucurbits and will discuss the future of fungicides. Drs. J. D. Wilson and H. C. Young of Wooster, Ohio will act as chairmen of these discussions, respectively. Scheduled for talks in the fungicides and the future section are J. C. Dunegan; Stephen S. Easter, Food and Agriculture Organization of the U.N.; Dwight Powell; James G. Horsfall, Connecticut Agricultural Experiment Station, New Haven; L. S. Hitchner, executive secretary of the A.I.F. Association; and representatives of a number of manufacturers of fungicides who will discuss fungicidal materials available for the first time for experimental use, or those being placed on the market as commercial products.

Other sessions will include the discussion of subjects such as diseases of fruits and ornamentals, J. R. Shay, chairman; physiology of fungi, G. B. Lucas, chairman; diseases of field crops, D. W. Chamberlain, chairman; virus diseases, E. C. Blodgett, chairman; breeding and disease resistance, T. C. Ryker, chairman; market diseases of fruits and vegetables, G. B. Ramsey, chairman; plant disease survey conference, Paul R. Miller, chairman; vegetable diseases, George Semeniuk, chairman; and miscellaneous papers on the final evening, with W. D. Thomas, Jr., chairman.

Meetings

Agricultural Chemicals wishes to publish the meeting date and place of any gathering concerned with manufacturing, distribution, application or discussion of chemicals for agricultural use.

Western Colorado Horticultural Society, Fifth Annual Meeting, Mesa College, Grand Jct., Colo., January 9 & 10, 1948.

American Association of Economic Entomologists (In conjunction with meeting of American Association for Advancement of Science.) December 27-30, Congress Hotel, Chicago.

American Phytopathological Society, Stevens Hotel, Chicago, Ill., December 28-30, 1947.

Cotton States Branch, A.A.E.E., Atlanta, Ga., February 4, 5, 6.

F. C. Nelson Council Chm.

The Thomas J. Headlee Research Fellowship in Entomology re-elected Franklin C. Nelson, Stanco, Inc. as chairman of its Advisory Council at the group's annual meeting held November 19 at Rutgers University. The fellowship, providing for basic research in entomology, was established in January, 1944, in honor of the late Dr. Thos. J. Headlee, former head of the entomology department at Rutgers and the New Jersey Agricultural Experiment Station.

The Council is composed of representatives of the 26 industrial and commercial firms and organizations whose subscriptions to date have totaled more than $27,000 available to endow the fellowship, in addition to annual contributions currently running in excess of $1,300.

Members of the Council, in addition to Mr. Nelson, are: Dr. J. L. Horsfall, American Cyanamid Company; Dr. H. H. Wellman, Carbide & Carbon Chemicals Corporation; Irwin W. Bales, Chipman Chemical Company; Dr. W. G. Dutton, Dow Chemical Company; Harold G. Olena, Goulard & Olena; E. A. Gauntt, GLF; A. C. Miller, Gulf Research and Development, Company; Dr. E. N. Woodbury, Hercules Powder Co., Inc.; R. E. Streckenbach, H. D. Hudson Manufacturing Company; H. G. Guy, Koppers Company, Inc.; P. E. Lirio, Lirio Co.; A. E. Badertscher, McCormick & Co., Inc.; Dr. Ralph Heal, Merck & Co., Inc.; Thomas L. Smith, Miller Chemical and Fertilizer Corporation; Thomas D. Mulhern, New Jersey Mosquito Extermination Commission; J. Edwin Sameth, New Jersey Pest Control Association, Inc.; Dr. C.

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"Thanite" Price Drops

Hercules Powder Co., Wilmington, Del., has announced a reduction of fifty cents per gallon in the price of "Thanite," insecticide concentrate made by the firm. The new price schedule applies to all shipments, from tank cars to single drum orders. The new price per gallon in tank cars is now $3.75, ranging up to $4.05 per gallon in lots of from one to four drums. The material is shipped F.O.B. Brunswick, Ga.

•

D&O Division to U.S.I.

U. S. Industrial Chemicals, Inc., has announced that effective January 1, 1948, the Insecticide Division of its subsidiary, Dodge and Olcott, Inc., New York, will be transferred to U.S.I. The parent company will operate the division as an integral part of its organization. Coordination of U.S.I.'s activities in the insecticide field will continue to be directed by R. B. Stoddard, with J. A. Rodda in charge of sales. Entomological research and development will continue under the direction of Dr. W. E. Dove, with the Fairfield (Md.) Entomological Laboratory headed by L. C. McAllister, Jr.

The new arrangement will enable Dodge & Olcott to concentrate its activities exclusively in the essential oil, flavoring and perfume raw material fields, and will place the facilities of U. S. I. at the disposal of insecticide manufacturers. Research work of Dodge & Olcott in the insecticide field was initiated in 1939. Since that time, the firm has developed a number of insecticide products now on the market.

New Buildings for N. Y. Experiment Station

Artist's conception of three new buildings to be erected at the New York State Agricultural Experiment station, Geneva. Left to right, they include a central heating plant for the entire station, a food research building with pilot plant attached, and a building to house the divisions of entomology and plant pathology. At the extreme right is the present horticultural building. The state legislature has already appropriated $1,307,100 from the Postwar Reconstruction Fund for the heating plant and the food research building. Plans for the latter are now complete.

A GROUP of three new buildings will be added to the New York State Agricultural Experiment Station, Geneva, it was recently announced by the station. The group proposed by the trustees of Cornell University for the development of the station, includes a central heating plant, a food research building with pilot plant, and a building to house the divisions of entomology and plant pathology.

Specifications for the buildings include Cornell stone, limestone and brick, with all outside trim of aluminum. No painted surfaces will be exposed to the weather. Among the features of the food research building will be movable metal partitions which will make possible the enlarging or reducing the size of laboratory rooms to accommodate various types of experimental work. The building will be ventilated so that odors or fumes from one laboratory cannot penetrate to another laboratory or into the halls. There will be more than 50 vent hoods to carry away fumes, while fresh air is brought into the rooms under slight pressure.

The pilot plant, 122 feet long and 60 feet wide, will have a traveling crane operating through its center. Balconies surrounding the pilot plant may be set at any three-inch level required for operating equipment in the building. Refrigeration rooms will reach minimums of 60 degrees below zero.

Topeka Conference Held

The annual meeting of the North Central States Weed Control Conference was scheduled to be held at Topeka, Kansas, December 10, 11 and 12. The conference includes midwestern 13 states; North and South Dakota, Wisconsin, Minnesota, Iowa, Nebraska, Illinois, Michigan, Indiana, Ohio, Missouri, Kansas and Oklahoma. The program was to include a number of symposia on weed control in agronomic crops, in horticultural crops, in woody plants, and on weed control equipment. Recommendations for control of various weeds were expected to be given at the conference, for publication later. President of the conference is Noel S. Hanson, University of Nebraska.

•

Canadian Weed Conference

A weed control conference was held November 25, 26, and 27 at Regina, Saskatchewan, Canada. Attending were growers and industry representaeives from various Canadian Provinces and from a number of border states of the U. S. The conference discussed topics relating to the control of weeds in securing better annual yields of wheat.

Chemical Problems Aired at Cornell Meeting

NUMEROUS reports on insecticidal and fungicidal results for 1947 were given at the 9th annual New York State Insecticide and Fungicide Conference at Ithaca, N. Y., September 13 and 14. All reports were preliminary, and will be for publication at later dates when all data are correlated. The sessions were held in the auditorium of Bibbins Hall, G. L. F. building at Ithaca.

The program was arranged by the Departments of Plant Pathology and Entomology of the College of Agriculture, Ithaca, and the New York State Agricultural Experiment Station, Geneva. As in the past, the central theme of the meeting was the presentation of recommendations for insect and disease control for the coming year on the major crops grown in the state, some of the pertinent research upon which these recommendations were based, as well as a review of the performance of a number of the newer materials during the past season. In this way, industry has the advantage of knowing what will be recommended for the coming season by the extension service as well as whatever guidance can be had from the indications of current research.

In addition to the reports of results of various toxicants, there were also discussions on application equipment, and movies showing some of the developments in this field.

The first morning session was opened with a paper by Lea S. Hitchner, executive secretary of the A.I.F. Association, New York, discussing the relation of the agricultural pesticide field to world food problems. Mr. Hitchner was unable to be present, but his paper was presented by Dr. Charles L. Smith of the A.I.F.A. S. A. Rohwer, assistant chief, Bureau of Entomology & Plant Quarantine, representing the U. S. Department of Agriculture, talked on the current problems facing the insecticide industry. He reiterated that cooperation between men of industry, state experiment stations and the Federal government is essential to helping the American farmer to produce more. He stated that there is now a particularly great opportunity in the pest control field; that the public demands more efficient methods of control. He stressed that the coming season will "make or break" the reputation of the industry in accomplishing its goals.

In connection with the New York State Insecticide and Fungicide law which was to become effective on November 15, chairman Massey called upon Dr. Buccholtz, N.Y. State enforcement officer, to say a few words. In reply, Dr. Buchholtz said that the State wants only to protect the user, and to enforce the law. He realized that it will take some time to accomplish these aims, he said, but they must be accomplished as soon as possible.

Dr. P. D. Peterson, American Fruit Growers, Inc., Hagerstown, Md., described some of the practical problems encountered by his firm in

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using the newer insecticides and fungicides during the past season, and Prof. O. C. French, head of the Department of Agricultural Engineering at Cornell told of problems encountered in seeking proper application of new toxicants. He emphasized that the introduction of new chemical materials should be accompanied by proper application machinery to give the material a better chance to do its work. Cooperative effort is needed . . . such as that carried on between the research committee of the Farm Equipment Institute and the equipment committee of the A. I. F. Association.

The afternoon session, under the chairmanship of Dr. Palm, was opened by a symposium on fruit disease research. Dr. J. M. Hamilton, N. Y. State Experiment Station at Geneva, spoke on fungicides in relation to control of apple scab, cherry leaf spot, and peach leaf curl. Dr. D. H. Palmiter, also of Geneva, reported preliminary results of tests with new fungicides on apples in the Hudson Valley; and Dr. W. D. Mills, Cornell, reported various tests with fungicides. Dr. A. J. Brann, Geneva, completed this portion of the discussion with a report on spraying for grape diseases. Dr. Mills appeared a little later to present fruit disease control recommendations for 1948.

The remainder of the afternoon was devoted to reports on fruit insect research, with summaries presented by Drs. P. J. Chapman, E. H. Wheeler, S. W. Harmon, J. E. Brann, and E. F. Taschenberg of Geneva; and Dr. J. E. Dewey and L. R. Brown of Ithaca. Dr. Dewey also presented the recommendations for 1948.

Friday morning's program with Dr. Hugh Glasgow as chairman, was opened by reports on vegetable insect control research, presented by Drs. Glasgow, G. E. R. Hervey and L. A. Carruth all of Geneva; Dr. T. C. Watkins, Ithaca, and Dr. H. C. Huckett, of the Long Island vegetable research farm. The preliminary recommendations for 1948 in this field were presented by Dr. R. W. Leiby of Ithaca.

Reports of vegetable disease were given by Drs. J. D. Wilson, Ohio Agricultural Experiment Station, Wooster; and Dr. W. T. Schroeder, Geneva. Dr. Wilson described results of new fungicides on vegetables, and Dr. Schroeder talked on spraying for the control of tomato diseases. Dr. C. Chupp, Ithaca, gave the recommendations for 1948.

The meeting continued throughout Friday afternoon under the chairmanship of Dr. W. T. Schroeder. A session on control of potato insects opened the after-lunch meeting. Speaking on soil insecticides for wireworm control, and the effect of such insecticides on tainting of tubers were Dr. B. B. Pepper of the New Jersey Agricultural Experiment Station, New Brunswick, N. J.; Dr. Douglas Greenwood, Connecticut Agricultural Experiment Station; and Dr. W. A. Rawlins, Ithaca. The 1948 recommendations for control of potato insects were presented by Dr. R. W. Leiby.

Continuing on the subject of potatoes, Dr. A. M. French and R. C. Cetas, Ithaca, reported on research for control of potato disease. The former spoke on results of field tests in western New York State, and the latter on results in the Long Island area. Dr. Chupp presented the 1948 recommendations for control of potato disease.

Problems of insect control on livestock were discussed by Dr. H. H. Schwardt, Ithaca; and Dr. W. E. Blauvelt, also of Ithaca, told of experiments in the control of greenhouse insects. The final portion of the program was devoted to talks on the subject of new application equipment, and pictures to illustrate such machines.

The meeting was the largest in the nine year history of the conferences. The auditorium was filled at each session. At a banquet at the Ithaca Hotel Thursday night, movies were shown of new application equipment used in various parts of the United States.

Packard New President of Eastern A.A.E.E.

THE Eastern Branch of the American Association of Economic Entomologists met in a two-day session at hotel Benjamin Franklin, Philadelphia, November 20 and 21. It was the group's 19th annual meeting. Officers elected for the year were Dr. C. M. Packard of the Division of Cereal and Storage Pests, Bureau of Entomology and Plant Quarantine, U.S.D.A., Washington, chairman and Franklin C. Nelson, Stanco, Inc., Elizabeth, N. J. vice-chairman. B. F. Driggers, Rutgers University, New Brunswick, N. J., was re-elected secretary-treasurer. Dr. Packard succeeds Dr. J. O. Pepper as chairman.

Among the more than sixty papers presented at the sessions, were various ones covering laboratory methods of evaluating insecticides, on toxicological studies of new materials, and reports on season's tests with insecticides against a wide variety of agricultural pests.

A paper by W. E. Blauvelt and J. R. Hoffman of Cornell University, Ithaca, described what were termed "outstanding results" with "Thiophos 3422" (O,O-diethyl O-p-nitrophenyl thiophosphate), an insecticide considered by many to be superior to DDT in toxicity to a considerable number of insect species. The subject dealt chiefly with use of the material in aerosols for greenhouse pest control, but indicated a much broader use of the insecticide.

Another talk by Dr. Lloyd W. Brannon, Norfolk, Va., described two new synergists for rotenone: piperonyl cyclohexenone and piperonyl butoxide, each of which were reported to increase the toxicity of rotenone to a significant extent.

Dr. Driggers related the results of experiments with benzene hexachloride for the control of plum curculio on peaches. He reported effective results, and stated that use of the insecticide was accomplished without disagreeable flavor in the fruit.

Aerosols and other application methods were discussed at the meeting. Philip Garman, Agricultural Experiment Station, New Haven, Conn., talked on the results of two years' experience with mist blowers for control of apple insects, reporting good results. Dr. Floyd F. Smith, R. A. Fulton and P. H. Lung, U.S.D.A. research center, Beltsville, Md., presented a paper which told of recent developments in the control of greenhouse pests with liquefied-gas aerosols. This paper included results of tests with DDT, hexaethyl tetraphosphate, and diethyl-p-nitro phenyl thiophosphate. A similar subject was discussed in a paper by Drs. L. P. Ditman and E. N. Cory, College Park, Md. They reported on experiments on the control of the bean beetle with liquefied gas aerosols.

Experiments on the application of dormant oils as mists were related in a paper by J. L. Brann, Jr., A. W. Avens, and R. W. Dean, all of New York Agricultural Experiment Station, Geneva. Their experiments had covered a period of two years in which they evaluated the efficiency of dormant oil emulsions applied in the form of mists. Data on oil deposit and European red mite control indicated success of trials.

•

Fertilizer Hearings in Dec.

Hearings on the fertilizer situation were scheduled to be held in Washington on December 9 and 10, by the subcommittee on fertilizers of the House of Representatives. Purpose of the meeting was to determine prospects for the 1948 planting season. The committee stated earlier that it wished to chart the progress of the fertilizer industry since the committee hearings last April, using as a basis the figures and other information presented at that time. The committee also expressed an interest in learning to what extent strikes or other production limiting factors have influenced industry performance since April, and the number and capacity of all of the various types of fertilizer plants projected at the present time.

•

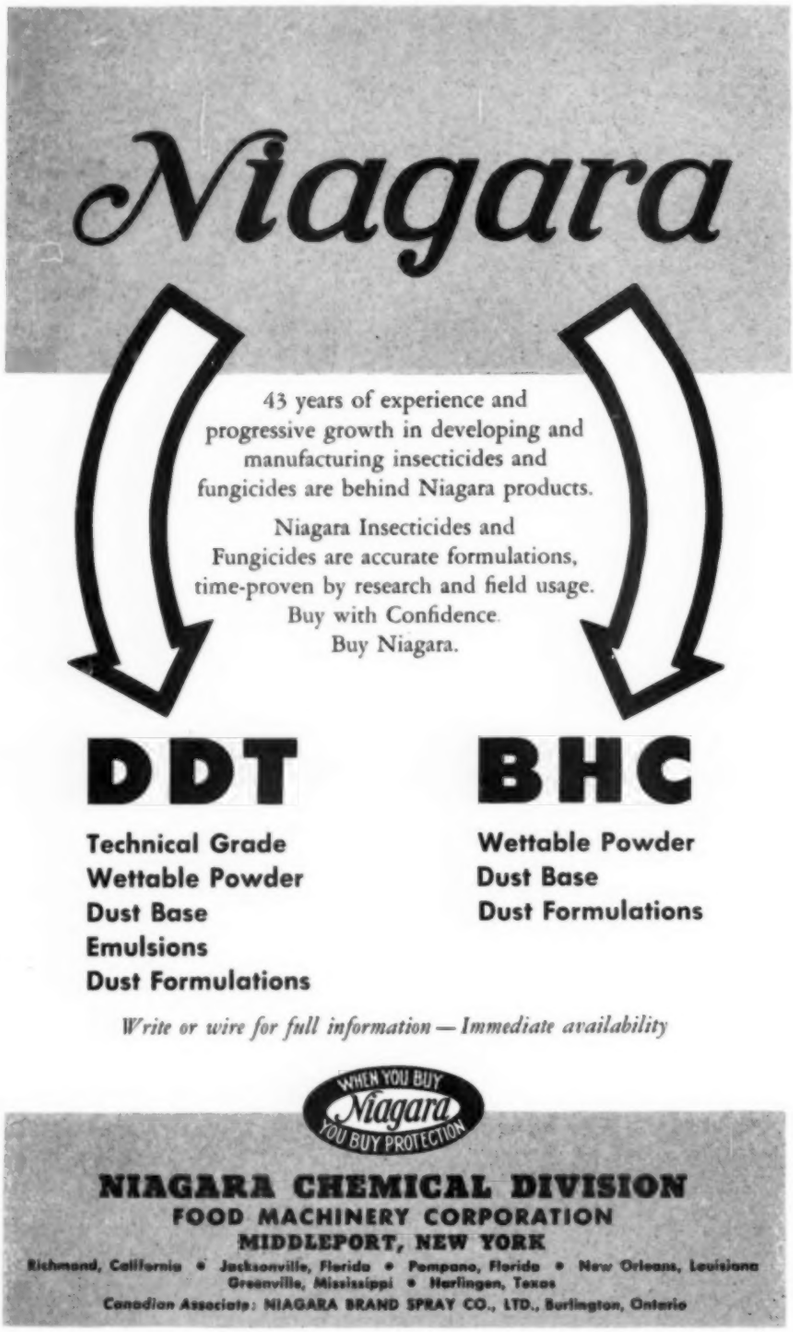
Joins Battelle Institute

Joseph J. Chamberlain has been appointed to the staff of Battelle Memorial Institute, Columbus, Ohio, where he will be engaged in research on the use of metals and chemicals in plant nutrition and insect control. Mr. Chamberlain, a graduate of Ohio State University, has operated the Beech Hollow Farm near Bellville, for the past seven years. He was previously engaged in agricultural research with the Ohio Agricultural Experiment Station at Wooster, and with Pennsylvania State College.

•

Opens New Western Lab.

American Potash & Chemical Corp. has opened a new $300,000 research laboratory at its Trona, Calif. plant. The new research addition covers 16,800 square feet, and has nine laboratories, special air-conditioning, research library, offices, and other facilities. Director of research at the Trona plant is W. A. Gale.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NAIDM Elects Baird at Baltimore Meeting

THE Nation Association of Insecticide and Disinfectant Manufacturers, Inc. elected as its president Gordon M. Baird, Baird & McGuire, Inc., Holbrook, Mass., at the group's 34th annual meeting at Baltimore, December 1, 2 and 3. Mr. Baird succeeds N. J. Gothard, Sinclair Refining Co., E. Chicago, Ind. Other newly-elected officers were L. J. Oppenheimer, West Disinfecting Co., Long Island City, N. Y., first vice-president; and Clarence Weirich, C. B. Dolge Co., Westport, Conn., second vice-president. Re-elected were H. W. Hamilton, Koppers Co., Inc., Kearny, N. J., and John Powell, John Powell & Co., New York, secretary and treasurer, respectively.

Discussions at the meeting included a question and answer session covering the new insecticide law, with Dr. W. G. Reed, chief, insecticide division, U. S. D. A., presiding; and a talk on registration procedure under the new law, by Sanford J. Hill, E. I. du Pont de Nemours & Co., Inc., Wilmington. Dr. F. C. Bishopp of the U. S. Department of Agriculture, Washington, discussed the future of large scale insect control operations through the use of insecticides, and Dr. J. C. Munch, Munch Laboratories, Upper Darby, Pa., talked on the rodenticide, "Antu."

Other topics on which papers were given included sanitation, household insecticides, various disinfectants and trade problems. Group luncheons were held on both Monday and Tuesday. The Hon. August Andresen, Congressman from Minnesota, spoke at the session, held Monday noon.

Joins Am. Potash & Chem.

Joseph S. Whittington, North Tarrytown, N. Y., has joined American Potash & Chemical Corp. as manager of sodium sulfate sales, the company announces. He has some 30 years of experience in the fertilizer and general chemical field, including positions with Ashcraft - Wilkinson Co., the Independent Fertilizer Manufacturers' Association, and F. W. Berk & Co., Inc.

•

New Plant Operating

Production has begun in the new sulfuric acid manufacturing plant of the Southern Acid and Sulphur Company, Inc., at N. Little Rock, Ark. Operation is expected to be maintained on a seven-day, 24-hour schedule. The plant, erected at a cost of $1,000,000 by the parent firm in St. Louis, Mo., will manufacture superphosphate fertilizers, process aluminum ores and process cottonseed oil.

Production of sulfuric acid will be more than 200 tons daily. The acid will be produced from a crude sulfur base obtained from south Arkansas gas fields. A pipeline from the plant will carry acid to the nearby Arkansas Fertilizer Company, owned by the same St. Louis firm. The company also operates plants at Bossier City, La. and Port Arthur, Tex. H. T. Galt of Port Arthur is plant superintendent of the North Little Rock factory.

•

Form Varley & Sons Co.

James Varley & Sons, Inc., will become the new company name of Baird & McGuire & Co. of St. Louis on January 1, 1948, according to an announcement by Jack C. Varley, vice-president. The company's policies, personnel and line of products will remain unchanged under the firm's new name.

The change in designation was decided upon to avoid confusion in the trade resulting from there being two firms operating under the former name of the St. Louis firm. The two had no financial or plant connections.

The St. Louis company of James Varley & Sons, Inc., has recently completed a large modern laboratory and office building, in connection with an expanded program of research and development in the insecticide and allied fields. The St. Louis branch of Baird & McGuire was established 26 years ago by James Varley and Campbell Baird. In 1939, James Varley purchased the Baird interests in the Missouri corporation, and since then the company has been operated under the Varley ownership. Associated with James Varley, president, will continue to be his sons, Jack C. as vice-president and general manager, and James G., secretary.

•

Torpin MGK Vice President

Paul D. Torpin was recently named vice president of McLaughlin Gormley King Co., Minneapolis, the company announces. Mr. Torpin has been with the firm for a number of years in the sales department, devoting his time principally to agricultural chemical sales.

•

Votes Research Fund

Commercial Flower Growers of Chicago, an organization of Cook County florists, has approved an appropriation of $2,000 for continuation of research at the Illinois College of Agriculture on problems affecting their interests. Next year's investigations will include efforts to evaluate the insecticidal qualities and to develop methods for using tetraethyl pyrophosphate and azobenzene. This work will be conducted by Goah Lynch, a fellowship student, who is working for his master's degree. On a recent field trip of the flower growers' organization, Archie Smith, of Smith Equipment & Supply Co., 1615 N. Central Ave., Chicago, demonstrated a "Hep Bomb," an atomizer for fumigating greenhouses with hexaethyl tetraphosphate.

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To Trap, Kill Beetles

California State Forest Rangers are planning an intensive battle against the Western Pine Beetle and the "Ips Beetle," pests which in two decades have destroyed thousands of pine trees in the Julian and Cuyamaca areas near San Diego. Infested trees will be felled and converted into traps for the beetles.

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N.E. Weed Conference

The Northeastern States Weed Control Conference will meet at the Hotel Commodore, New York, for two days beginning Thursday, February 12. Papers covering control of weeds as related to vegetables, turf, pasture and field crops, fruits, nursery crops and ornamentals are expected to be presented. Chairman of the program committee is Dr. Benjamin Wolf, Seabrook Farms, Bridgeton, N. J.

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Edco Plant Moves

Edco Corporation has announced its new location at Elkton, Md. Formerly located at Newark, Del., the plant had outgrown its old facilities. Edward Dobbin, president of the firm which manufactures industrial and greenhouse aerosol bombs, says that the increase in production and the speeding up of deliveries will amount to an improvement of about 75 percent.

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Donates Pyrethrum

A story in the *East African Standard*, published at Nairobi, tells of pyrethrum powder and extract being flown to Egypt to be used in the anti-cholera campaign. The shipment consisted of 1,500 pounds of extract, enough to make 30,000 gallons of spray. The extract was donated by a group of East African companies, and the powder by the Kenya Pyrethrum Board. Value of the gift was estimated at £4,100.

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Chemical Exposition, N. Y.

Manufacturers of insecticides, fungicides, weed killers and of numerous machines used in their processing, had displays at the Exposition of Chemical Industries held at Grand Central Palace, New York, December 1-6. Record crowds attended the exposition.

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Curtis Joins G.L.F.

Lloyd Curtis of Buffalo, N. Y., has joined Cooperative G.L.F. Exchange, Inc., Ithaca, N. Y., where he will serve as technical field man in the Co-op's soil building division. Here he will develop fertilizer programs among patrons and work closely with them on pest control problems. Since graduation from the New York State College of Agriculture, where he majored in plant pathology, Curtis has been with the federal agricultural extension service, as county agent in several New York counties.

•

Verrault Joins Prentiss

R. J. Prentiss & Co., New York, has announced the addition of Howard Verrault to its sales staff. Mr. Verrault, formerly of Velsicol Corporation, Chicago, will operate in the New York territory.

The Prentiss Company has also opened a new plant in Richmond, California, in charge of E. S. Heckathorn, formerly of the New York office. The new plant is equipped with machinery for milling and mixing DDT, BHC and other basic insecticides.

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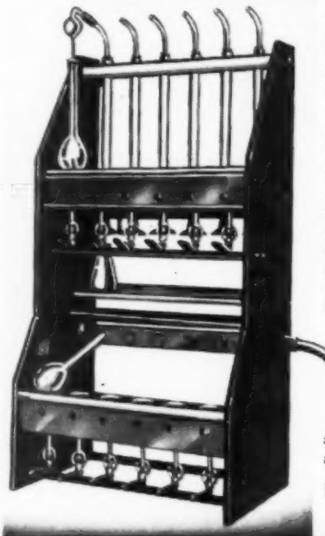

The new "Precision" Junior Kjeldahl Combination Unit features the new aspirator which eliminates the need for a hood when running digestions. The use of 300 ml. Kjeldahl flasks makes this unit extremely suitable for semi-macro work. Using one gram samples, it is possible to obtain the accuracy of the macro method plus the time-saving a small sample allows.

EFFICIENCY FEATURES: Adjustable gas burners have crown top which breaks flame into seven intense jets, eliminates spot heating. Stainless steel flame shields confine heat and shut out drafts. Individual distillations unit condenser tubes are of Pyrex glass.

NEW TYPE ASPIRATOR

The special aspirator, of 80 mm. Pyrex tubing, is designed to eliminate the need for a hood by removing the acid fumes down the drain, mixed with a huge excess of water.

Write for Kjeldahl Bulletin 550-L.

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Scientific Research and Production Control Equipment

for '48 it's

Toxaphene*

[HERCULES CHLORINATED CAMPHENE]

Ample supplies of this new Hercules toxicant will be available for insecticide manufacturers in time for 1948 demands. Users will look for the words "Toxaphene" or "Chlorinated Camphene" on the label. Find out about Toxaphene *first* in '48!

HERCULES POWDER COMPANY
INCORPORATED
970 Market Street, Wilmington 99, Delaware

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Matthysse to Cornell

J. G. Matthysse was to join the science staff of Cornell University December 15, to take charge of research and extension on control of insects ornamentals, turf, and shade trees. Mr. Matthysse was formerly associated with Geigy & Co., Inc., New York; and J. T. Baker Chemicals Co., Phillipsburg, N. J.

GREENHOUSE AEROSOLS

(*Continued from Page 31*)

have been maintained to avoid plant injury.

Effect on Greenhouse Pests

IN these experiments adults of whiteflies, leaf tiers, the azalea leaf miner, broad mite, and thrips were apparently irritated by the DDT aerosols, particularly when cyclohexanone was used, for they flew or moved rapidly about for a few minutes before tremors leading to paralysis set in. The green peach aphid and the chrysanthemum aphid were more slowly affected, and colonies survived for several days to 2 weeks. The rose aphid and the melon aphid were not affected. Sowbugs and centipedes were very susceptible and were killed by DDT residues on gravel or cinders that had been in the bench for several days. The American roach and the European house cricket were also killed by such residues.

Hatching thrips larvae and adults emerging from pupae or flying from untreated plants were killed by DDT residues that had been on the foliage for at least 4 days, as determined by affected insects dropping to papers beneath plants. As many as 200 thrips were collected per square foot of paper after treatment. It was observed that both adults and larvae of the onion thrips, the chrysanthemum thrips, and the banded greenhouse thrips moved about and fed on both surfaces of foliage thereby coming into contact with the residues of DDT deposited on the upper surfaces. This residual action appeared to last longer in the fall and winter than in late spring and summer when temperatures were higher. A single application in October so reduced thrips on chrysanthemums that no other treatment was necessary. On cucumbers, one application in January protected the plants for 6 weeks, but later in the spring two applications from 7 to 10 days apart were necessary to bring an infestation of thrips under control. For whiteflies, azalea leaf miners, greenhouse leaf tiers, and certain other pests three treatments at weekly intervals were necssary to bring infestations under control. The grower should exercise his judgment in determining the frequency of treatments to control the pests under his particular conditions.

Part II of this article will appear in the January issue.—EDITOR.

FERTILIZER PROGRESS

(*Continued from Page 24*)

the prewar development of deposits

A Standard Carrier for Insecticidal and Fungicidal Dust

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TALC

This grade of talc has proper and efficient bulking characteristics

SOFT flaky particles which enhance stickiness.

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for '48 it's

Toxaphene*

[HERCULES CHLORINATED CAMPHENE]

Hercules plant expansion assures an unfailing supply of Toxaphene for agricultural insecticides in 1948. Initial results of large-scale field tests indicate its effectiveness and economy —especially against cotton insects. Find out about Toxaphene *first* for '48!

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N77-9C

in New Mexico on such a scale that it was possible to produce not only enough potash to compensate for the lack of imports from Germany and France, but also to meet large additional demands created by the war. Thus, the output of potash sales, including the production from lake brines rose steadily from some 310,000 tons of K_2O in 1939 to 932,000 tons in 1946. In the same period the domestic use of potash as fertilizer increased from about 409,000 tons to 819,000 tons.

With the development of the domestic potash industry the trend has been markedly towards the production and use of highly concentrated salts, as evidenced by the fact that nearly pure potassium chloride containing 60 percent or more of K_2O furnishes approximately 80 percent of the potash now consumed as fertilizer in the U. S. The comparable proportions in 1935 and 1937 were 30 percent and 48 percent, respectively. Supplies of potassium sulfate, formerly obtained largely from Europe and needed chiefly for the growing of tobacco, were maintained at a high level during the war, although this was not entirely adequate. The production of the sulfate was accomplished by interaction of potassium chloride with sulfuric acid as well as with certain sulfate minerals which occur in the potash deposits of New Mexico and California. Also, a process for the production of sulfate of potash-magnesia from the deposits in New Mexico was developed and put into operation, thereby affording a supply of agricultural water-soluble magnesium to replace material formerly imported from Germany.

Mixed Fertilizers

IN recent years about 60 to 70 percent of the total quantity of nitrogen, P_2O_5, and K_2O consumed as commercial plant food has been in the form of mixed fertilizers. It is estimated that the quantity so consumed in 1946 approximated 2,250,000 tons contained in some 10,500,000 tons of fertilizer. The formulation, manufacture, and use of mixed fertilizers present important problems of plant-food concentration, chemical reactions, and physical condition.

The question of plant-food concentration has received much attention, and significant progress has been made towards its solution. Thus, the total proportion of nitrogen, P_2O_5, and K_2O in mixed fertilizers increased steadily from 17.9 percent in 1930 to 18.3, 19.9, and 21.6 percent in 1935, 1940, and 1946, respectively. Although the proportion in 1946 represents an increase of 21 percent over the 1930 figure, there is still room for much improvement. With the fertilizer materials now commonly available, the preparation of mixtures averaging at least 25 percent of plant food is technically feasible and agronomically sound. The applied-to-the-soil cost of a unit of plant food is usually less with such mixtures than with those of lower concentrations.

It is not possible to make complete mixtures that are 100 percent

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for '48 it's

Toxaphene*

[HERCULES CHLORINATED CAMPHENE]

During 1947, state entomologists, extension stations, and other agricultural authorities used over 2,000,000 lbs. of 20% Toxaphene to test its effectiveness against cotton insects and other pests. Find out about Toxaphene *first* for '48!

HERCULES POWDER COMPANY
970 Market Street, Wilmington 99, Delaware

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plant food in terms of nitrogen, P_2O_5, and K_2O, because each of these plant foods must be combined with other substances in order to obtain usable products. Also, it is generally desirable that the mixtures contain the secondary plant-food elements (calcium, magnesium, and sulfur) and often the so-called trace elements (boron, manganese, copper, and zinc). By the use of high-analysis fertilizer materials, however, satisfactory mixtures can be prepared readily, containing at least 30 percent of nitrogen, P_2O_5, and K_2O, together with adequate quantities of the secondary and trace elements.

Efforts have been made for some years to reduce the number of grades of marketed mixed fertilizers, but comparatively little progress was noted until recently. Wartime problems of labor and of utilization of factory space and equipment, together with limitations imposed by Government agencies responsible for fertilizer supplies, were important factors in bringing about a marked decrease in the number of grades. In the fertilizer year 1938-39, some 982 grades of mixtures were reported to have been sold. Subsequently, the number dropped to 271 between 1942 and 1945 and was 306 in 1945-46.

The increasing recognition of the importance in plant nutrition of the secondary and trace plant-food elements, such as magnesium, boron, manganese, copper, etc., together with a better delineation of the areas in which soil deficiencies of these elements occur, has directed attention to their inclusion in mixed fertilizers. Addition to mixed fertilizers of dolomite, which supplies magnesium and also serves as a conditioner and as an agent to neutralize the potential acidity of ammonium salts, has now become a common practice in large sections of the country. In some areas soil deficiencies of boron are being overcome by the inclusion of borax in the mixtures, while in others salts of manganese, copper, etc., are added.

The physical condition of mixed fertilizers, one of the industry's most troublesome problems, has received much attention in recent years, especially with respect to drillability and to the segregation of the component materials.

The problem is complicated by the wide and changing variety of the materials, differing greatly in chemical and physical properties, which enter into the mixtures. Nevertheless, definite progress towards its solution has resulted from studies of such phases as caking, particle size distribution, and moisture relationships. Proper sizing of the particles, as, for example, by granulation of the materials and mixtures, hinders segregation and caking and improves drillability. Granulation methods have been developed and put into operation. Such treatment of superphosphate is practiced at several domestic plants, and solid ammonium nitrate for fertilizer use is marketed only in granular form. Granulation of mixed fertilizers is still in the process of development in the United States,

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Here are some quick facts on Micron Measured Sulphur. Read them over carefully and you'll have to agree that Micron Measured Sulphur is a natural for the control of scab on apples and brown rot on peaches.

1. PARTICLE SIZE—Between 4 & 5 microns, surface average diameter, which is 10 times finer than the opening in a 325 mesh screen.
2. SULPHUR CONTENT—Wettable not less than 95%. Dust not less than 90%.
3. EXCELLENT COVERAGE AND ADHERENCE—Extremely fine particles give even distribution over fruit and leaf surfaces forming a protective layer which withstands weathering.
4. EASY TO HANDLE—Micron Measured Wettable Sulphur goes into suspension immediately upon being placed in the spray tank. Micron Measured Dusting Sulphur is non-lumping and free-flowing.
5. NO LOSS—Both wettable or dusting can be stored without deteriorating or lumping.

CONTROLS THESE PESTS

The pests shown below can be controlled under average conditions by the use of Micron Measured Sulphur. Consult your local agricultural authority for recommendations as to the amount of spraying or dusting sulphur to use.

APPLES, PEACHES, PEARS, CHERRIES AND PLUMS: Brown Rot, Scab, Red Spider.
GRAPES AND STRAWBERRIES: Powdery Mildew, Red Spider.
CURRANTS, GOOSEBERRIES AND RASPBERRIES: Powdery Mildew
BEANS AND PEAS: Powdery Mildew
CITRUS: Rust Mite, Scale Crawlers, Red Spider
ROSES, PERRENIALS, ORNAMENTAL SHRUBS AND OTHER PLANTS: Black Spot, Powdery Mildew.

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for '48 it's

Toxaphene*

[HERCULES CHLORINATED CAMPHENE]

This new Hercules toxicant has proved itself in effectively controlling cotton insects, grasshoppers, Mexican bean beetles, tobacco hornworms and budworms, sugar cane borers, bagworms, rice stinkbugs, and other insects which attack crops. Find out about Toxaphene *first* in '48!

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though done rather extensively in certain foreign countries.

The moisture content of mixed fertilizers bears an important relationship to their physical condition. The expanding use of highly soluble salts, like ammonium nitrate and urea, has served to emphasize this relationship, because of their effect in increasing markedly the volume of the liquid phase of the mixtures. Improvement in the physical condition of fertilizers is being effected by closer control of the moisture content of the materials and mixtures, as well as by better packaging.★★

An extensive bibliography for this article will appear next month.—EDITOR.

LISTENING POST

(*Continued from Page 43*)

uted about equally through all the fields while the yellow bean mosaic, which is by far the most destructive of the two diseases, is most prevalent around the borders and lessens in severity towards the middle of the fields. Most of the small fields are almost completely destroyed while the large fields show areas in the middle that still remain productive.

The pods from infected plants are small, stringy, and poor in color. In general, pods from infected plants are very poor in quality and are not wanted by the cannery.

Circumstantial evidence points to the sweetclover, one of the hosts of the yellow type of mosaic, as the principal source of the infection. Sweetclover is abundant along fence lines, roadsides, and ditch banks in the Cache Valley. The disease is most severe in fields near waste areas overgrown with this host. Whether there are other wild hosts of the virus growing in the waste areas is not known. One small garden plot of pole beans growing near a few rows of gladiolus was completely destroyed. There was no sweetclover sufficiently close to this spot to account for such unusual and complete destruction.

The aphid population was very large in bean fields throughout the Valley during the early summer period. This probably accounts for the extensive and rapid distribution of the viruses in the bean fields. Both of these diseases are present in bean fields every year, but they reach such destructive proportions only in years when the aphid population is sufficiently large to distribute the viruses through the fields.

NFA MEETING

(*Continued from Page 34*)

000 acres in 1947, and that next year's total is likely to run well into the millions. Dr. Andrews described the cost of equipment as amounting to around $1,000 for tractor and trailer tank. He also explained the properties of anhydrous ammonia, and discussed briefly the factors affecting the use of the material. Methods of application, and the responses of various crops to the material were also described.

The afternoons of Tuesday and Wednesday were reserved for

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[HERCULES CHLORINATED CAMPHENE]

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golf on a number of Atlanta courses. The Association's annual dinner was held at the Biltmore on Tuesday evening.★★

RODENT CONTROL

(*Continued from Page 27*)

and thus makes a useful raticide. It is generally recommended in a proportion similar to red squill, roughly five percent. For best results, a high grade, finely ground quality must be used. If not completely pulverized, a slight grittiness results which detracts from its appeal. A pound of cornmeal slowly added to a can of salmon and pulverized with a spoon to make a homogeneous mass is recommended. After the two are thoroughly incorporated, two ounces of arsenic are added with a salt shaker, a little at a time. Baits the size of a hickory nut are then distributed. Arsenic dusted on diced carrots or apples is efficient in destroying orchard mice.

Phosphorus, Strychnine

PHOSPHOROUS is widely used in commercial rat poisons. It is usually prepared in the form of a paste. Since phosphorous is dangerously poisonous to other animals, and no effective antidote is available, use of this material is not recommended.

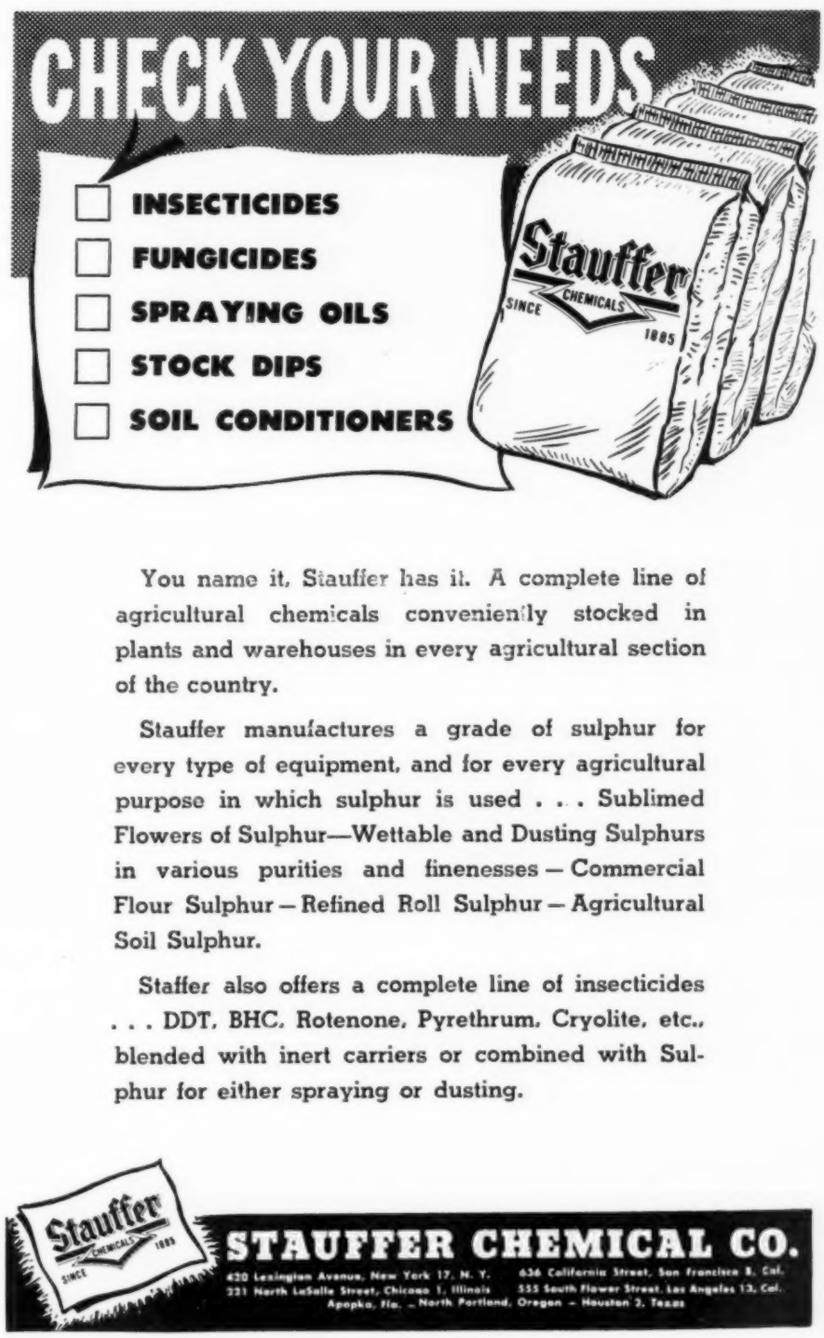
Strychnine (strychnia sulfate) is a virulent poison, acting with great rapidity. Because of its bitter taste, some element must be added to overcome this fault. Twice the amount of baking soda will help to minimize the bitterness, and make the poison more acceptable. Strychnine should be used at the rate of one part of the poison to 80 parts of bait by weight. Since the poison works very rapidly, it is safer to use it on dumps rather than in buildings.

Thallium Sulfate

THALLIUM sulfate is a cumulative and powerful poison, acts slowly, but is positive in its results. It has been used for the destruction of prairie dogs, ground squirrels and other rodents as well as rats. It is used in a proportion similar to strychnine. The writer has used it in typhus control campaigns in Texas and elsewhere with excellent results, particularly in large cities. The poison should be handled with gloves and the bait wrapped in cellophane before placing in buildings. It is not considered safe to use about the farm.

Barium carbonate is a white salt, presumably odorless and tasteless. Mildly poisonous, its action permits the rat to leave the premises before death intervenes. The writer used this poison in many army camps during the war and directed its use in Germany's rubble, with excellent results. It should be used in the ratio of one part of poison to five parts of bait.

Thus the chemical warfare against rats and other rodents moves onward with new methods and more powerful materials coming into use. American agriculture has much to gain in ridding itself of the voracious rat. Employment of the foregoing methods, used at proper times and in proper places, may go a long way in achieving this goal. ★★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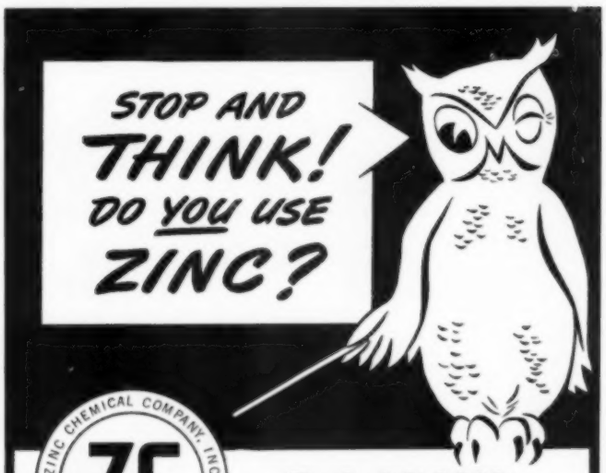

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There is nothing complicated about the use of *Mul-si-mo*. It is just poured into the oil to be treated at the rate of ½ to 1%, depending upon the tightness of emulsion desired—then thoroughly stirred—and the process is completed.

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Extensive tests have shown *Mul-si-mo* to be non-toxic to plants when used at a dilution of 1 to 100. (Plants used in tests—Coleus.) As summer oils are usually used at the dilution of half-gal. to 100 gals. water, at such dilution the rate of *Mul-si-mo* to water would be 1 to 20.

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Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

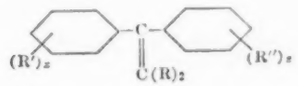
2,428,494. PYRETHRIN AND DIBENZYL PHTHALATE INSECTICIDE. Patent issued October 7 to Howard A. Jones, Orlando, Fla., and Raymond C. Bushland, Ft. Worth, Texas, assignors to the U.S.A. An insecticidal composition comprising pyrethrum and dibenzyl phthalate.

2,428,738. POLYALKYL AROMATIC INSECTICIDES Patent issued October 7 to R. R. Dreisbach and F. W. Fletcher, Midland, Mich., assignors to Dow Chemical Co., Midland. An insecticidal composition comprising an inert carrier and a high-boiling fraction of the reaction product obtained by heating naphthalene and diethylbenzene with a Friedel-Crafts catalyst, said fraction boiling above 230°C. at 25 mm. pressure, having a specific gravity of 1.00 to 1.05 and a refractive index of 1.60 to 1.63, and said carrier being of the group consisting of powder, wetting agent, solvent, water, and mixtures thereof.

2,428,844. FLY SPRAYS. Patent granted October 14, to Samuel I. Gertler and Herbert L. J. Haller, Washington, D. C., assignors to the U. S. of America. A fly spray comprising a member selected from the group consisting of N,N-diisopropylacetamide, N,N-diisobutylacetamide, and N-heptylacetamide as its essential knockdown agent and 2,2-bis (p-chlorophenyl)-1,1,1-trichloroethane as its essential active insecticidal ingredient incorporated in a mineral oil carrier.

2,429,092. INSECTICIDAL COMPOSITION. Patent granted October 14, to Stephen C. Dorman, Berkeley, Calif., assignor to Shell Development Co., San Francisco. An insecticidal composition comprising pyrethrum and para-amino dimethyl aniline.

2,429,839. DIARYL-DICHLORO-ETHYLENE COMPOUNDS AS INSECTICIDES Patent granted October 28, to Paul Muller, Neu-Allschwil, near Basle, Switzerland, assignor to J. R. Geigy, A.G., Basle, Switz. A method of destroying insects which comprises applying to the insects an insecticidal composition of matter, an active toxic ingredient of which is a compound of the formula



wherein R stands for a member selected from the group consisting of chlorine and bromine, each of R′ and R″ stands for a member selected

INTRODUCING

CONTINENTAL CLAY

A kaolin specially processed for use as a carrier or diluent for agricultural toxicants. Of particular value for dust concentrates because it combines good dry flowability with ease of wetting.

R. T. VANDERBILT CO., Inc.

Specialities Department

230 Park Avenue, New York 17, N. Y.

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PYROPHYLLITE • KAOLIN
DISPERSING AGENTS
SODIUM SELENATE

Literature and samples available on request

from the group consisting of hydrogen, chlorine, bromine, alkyl and alkoxy, and stands for one of the integers 1 and 2.

2,429,818. PYRETHRIN AND DIALKOXYALKYL PHTHALATE INSECTICIDE. Patent granted October 28, to Howard A. Jones, Orlando, Fla., and Raymond C. Bushland, Ft. Worth, Texas, assignor to the U.S.A. An insecticidal composition comprising pyrethrum and di-beta-methoxyethyl phthalate.

2,430,342. FUNGICIDE COMPOSITIONS. Patent issued November 4, to John Franklin Kagy, Long Beach, and Kenneth D. Sloop, Yorba Linda, Calif., assignors to Dow Chemical Co., Midland, Mich. A dust concentrate adapted to be dispersed in water to form agricultural fungicide spray compositions and consisting essentially of from 0.5 to 3.0 percent by weight of oil deposited on finely-divided chloranil, and intimately mixed therewith the minimum amount of wetting agent required to accomplish the dispersion of the composition in water.

2,430,721. N-NITROSO-N-ARALKYL-ARYLAMINES AS INSECTICIDES. Patent issued November 11, to E. C. Ladd, Passaic, N. J., assignor to U. S. Rubber Co., New York. An insecticidal composition comprising an N-nitroso-N-aralkyl-arylamine as an essential active ingredient, and a carrier therefor selected from the group consisting of clay and talc, and water containing a dispersing agent.

2,430,722. DERIVATIVES OF CHLORINATED QUINONES AS FUNGICIDES. Patent issued to E. C. Ladd and Merlin P. Harvey, Passaic, N. J., assignors to U. S. Rubber Co., New York. A fungicidal composition comprising as an active ingredient a derivative of a chlorinated quinone selected from the group consisting of tetrachloro-parabenzoquinone and 2, 3-dichloro-1,4-naphthoquinone in which a chlorine atom is substituted by the residue obtained by removing a hydrogen from the active methylene group of a compound selected from the group consisting of oxalocetic esters, acetoacetic esters, malonic esters, malononitrile, and *a*-cyanoacetic esters, said fungicidal composition containing a carrier selected from the group consisting of powdered solid carriers, and water containing a dispersing agent.

Trade Mark Applications

CULICIDE, in stencil capital letters, for insecticide. Filed Nov. 9, 1946, by Socony-Vacuum Oil Co., Inc., New York. Claims use since Apr. 4, 1945.

MOTIF OF CARTOONED ELEPHANT WITHIN CIRCLE, for insecticides. Filed Feb. 18, 1947, by Geigy Co., Inc., New York. Claims use since Jan. 17, 1947.

RODEX, in sans serif capital letters for rodent poison. Filed June 3, 1947, by West Disinfecting Co., Long Island City, N. Y. Claims use since Mar. 15, 1947.

GREEN THUMB, capital letters atop drawing of hand with thumb protruding upward, for fertilizers. Filed June 29, 1946, by R. D. M. Corp., Pasadena, Calif., assignor to Chemical Plant Foods, Inc., Los Angeles. Claims use since June 1, 1945.

ORTHO-FUME, in sans serif capital letters, for parasiticides—namely, insecticides, fungicides, disinfectants, and soil fumgants. Filed Feb. 3, 1947, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Jan. 15, 1947.

BIOBANE, in gothic capital letters, for chemical toxicants for use as agricultural insecticides, fungicides and herbicides. Filed Mar. 24, 1947, by Monsanto Chemical Co., St. Louis. Claims use since about Feb. 7, 1947.

NAY POSITIVE, in hand-lettered capitals, for rat bait, roach and ant poison, insect surface spray containing 5 percent DDT, etc. Filed Apr. 7, 1947, by Nay Laboratories, Inc., Cincinnati, Ohio. Claims use since Dec. 16, 1946.

COMPARE RESULTS, picture of penguin with lettering at side, for fertilizer and fertilizer materials. Filed Mar, 21, 1947, by Naco Fertilizer Co., New York. Claims use since Apr. 1, 1933.

SMICO, in outline letters, for insecticides. Filed June 19, 1947, by Benjamin D. Smith, doing business as

AMAZING
NEW
ORGANIC PHOSPHATE
INSECTICIDE
Eston
TETRON
Tetraethyl Phosphate—Technical
BETTER KILL
LOWER COST
This amazing new basic insecticide material is a revolutionary improvement on standard HETP for control of aphids, spider-mites and other insects.
Eston TETRON has approximately twice the strength of standard HETP and the price per unit of active ingredient has been drastically reduced.
AVAILABLE IN 3 FORMS:
TETRON 100
A straight chemical containing 100% active ingredient.
TETRON 50
50% active ingredient plus 50% solvent and emulsifier.
TETRON 25
25% active ingredient plus 75% solvent and emulsifier.
Eston TETRON is manufactured under the same close chemical and biological control that characterizes Eston HETP. Each plant run is checked before shipment to guarantee uniformity of performance.
Immediate delivery — substantial quantities. Write or wire for full price and technical information.
Eston TETRON
In the West it's Eston
*TRADEMARK REGISTERED
Eston
CHEMICALS, INC.
3100 East 26th Street
Los Angeles 23, California

Smith Mfg. Co., Utica, N. Y. Claims use since Apr. 1, 1921.

BEAUTYKOTE, in capital and lower case, for insecticide in powder and liquid form. Filed Aug. 9, 1946, by Beautykote Corp., Newark, N. J. Claims use since July 12, 1946.

4-ALL, in capital letters, for combinations of soil conditioning and chemical ingredients which are supplements for fertilizers. Filed May 20, 1946, by Clarence R. Rex, Toledo, Ohio. Claims use since February, 1935.

ORTHENE, in sans serif capital letters, for fertilizers. Filed Mar. 17, 1947, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Feb. 7, 1947.

TRI-6 No. 50W, in black capital letters for insecticides. Filed June 12, 7947, by Thompson-Hayward Co., Kansas City, Mo. Claims use since Apr. 5, 1947.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

Positions Open

Salesman Wanted by a national manufacturer of insecticides and fungicides: 1 salesman, preferably with agricultural education or background, to cover area in Northern California. Straight salary plus traveling expenses. Address Box 205 care of Agricultural Chemicals.

Wanted Insecticide Sls. Mgr: Insecticide sales manager for Midwestern mfgr. entering retail insecticide field. Four thousand established outlets on other products manufactured by the company. Excellent opportunity for man experienced in the sale of insecticides. Address Box 206 care of Agricultural Chemicals.

Chemist: Person with several years experience in insecticides, fungicides, wetting agents, etc. production, control or research wanted by nationally known manufacturer. Location midwest. Good opportunity. Give details past experience, salary, etc. Address Box 208 care of Agricultural Chemicals.

Position Wanted

Chemist, B.S. 1943 desires technical sales position. Familiar with insecticides—DDT, piperonyl butoxide, benzene hexachloride, chlordane, etc. . . . also synthetic resins. Will travel. Address Box 207 care of Agricultural Chemicals.

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist
(Formerly Director of Science, Government of the Philippine Islands; Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)
ADVISOR ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS
Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.
1118 Emerson Street
Palo Alto, California

Insecticide Sales—Graduate biologist with background of research & technical sales in rodenticides and insecticides, desires new connection with manufacturing organization in sales work. Age 35. For further details, write to Box 209 care of Agricultural Chemicals.

Miscellaneous

For Sale: Surplus stock of No. 1 dust guns, about 50,000. Also about 10,000 assorted shipping cases. Quotations and samples will be sent upon inquiry. Address Box 204 care of Agricultural Chemicals.

Back Issues Wanted: Wanted to complete library file of Agricultural Chemicals certain back copies of which the publisher's stock is exhausted, i.e. May, July, Aug. and Sept., 1946, all Vol. I. If you have copies of these issues which you do not need, will you contribute them to the library file of the Plant Pathology Section of one of our leading universities? Send direct to Prof. James H. Jensen, University of North Carolina, Raleigh, N. C. To any of our readers who can help out with these missing issues, we will be grateful and so will Prof. Jensen.—The Editor.

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". . . and what's more, check up on delivery of dat bike wot you promised me last year!"

Reminder...

EVEN Santa Claus forgets . . . has to be given a gentle reminder . . . maybe, like you, he can't make delivery under present circumstances . . . but, Santa Claus' customers never forget HIM . . . yours, however, can and may forget you all too soon, if you don't keep reminding them everlastingly of your business and your products . . . and for the most effective and economical "reminding" job, the concentrated and specialized circulations of industry publications are best . . .

If it be in the field of fertilizers, insecticides, fungicides, weed killers, and related chemicals for agriculture where you want a "reminder" job well done, we suggest the advertising pages of

AGRICULTURAL CHEMICALS

254 WEST 31st STREET NEW YORK 1

TALE ENDS

THE Agricultural Chemicals division of Pennsylvania Salt Mfg. Co. has a sales force which could probably be termed a "hard-hitting" outfit. Among its members are some huskies who in former years performed on various football gridirons around the country. These include Roy Shaneman, former lineman from the University of Oregon; "Buck" Francis, U. of California, end; Dean McCrory, Franklin & Marshall University, center; Cullen Rogers, Texas A&M, and later a pro with the Pittsburgh Steelers, quarterback; Kenneth Krausche, Rhode Island State, back; and Marty Johnson, St. Joseph College, end. The average weight is somewhat over 200, which may or may not account for some "heavy" selling on their part.

•

Cyanide has become a successful "coyote-getter" on the ranges of Arizona, according to E. M. Mercer, district supervisor of the United States Fish and Wildlife Service, Phoenix. The method has been devised so that as the animal prowls, he catches the scent of jerky. Powdered jerky sprinkled on a cloth and dipped in paraffin to stiffen it, is used as the lure. Beneath it, buried flush with the ground, is the "coyote-getter," a metal tube filled with sand. The firing device is a percussion cap—with a blank .38 caliber shell and a little cyanide—which is screwed into the tube. When the animal tugs at the bait, he causes an explosion which directs the cyanide into the coyote's mouth. Usually he dies after running only a few yards.

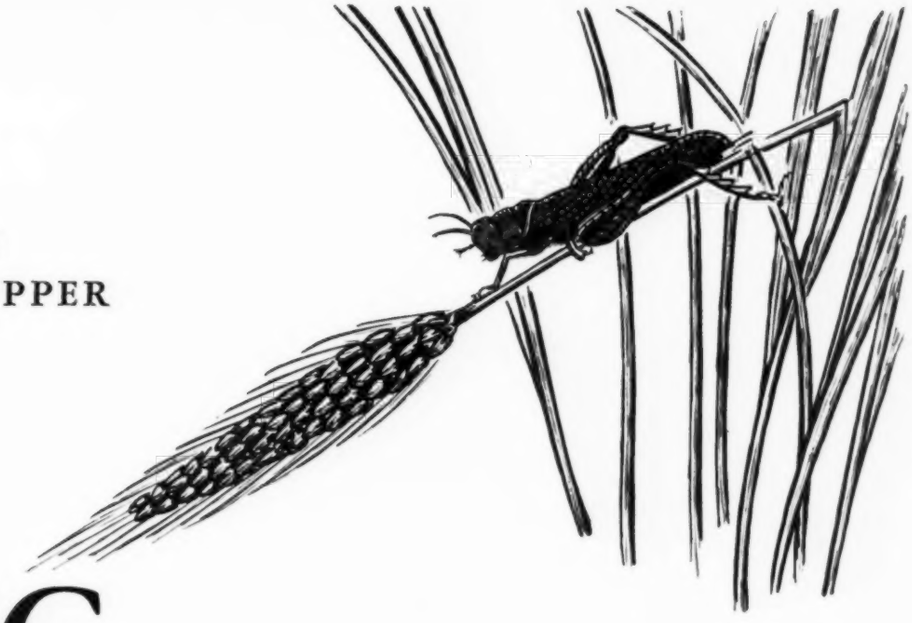
Some 45 coyotes were reported killed in one week in the Seligman, Arizona area. This is said not to attract livestock, and is harmless to humans.

•

Elmer Bird, a Colonel in World War II, owns a new fertilizer plant at Napa, California, and employs only ex-service men to operate the business. The firm mixes and distributes fertilizer materials to growers in the area.

PRINTED BY WATKINS PRINTING CO., BALTIMORE

THE
GRASSHOPPER



BUG OF THE MONTH

...controlled with BHC, CHLORDANE, TOXAPHENE

GRASSHOPPERS in teeming swarms have chewed a path through all of recorded history. From the Biblical "plague of the locusts" to the world-wide infestations this year, they have brought famine and death to millions of human beings.

With the new chlorinated toxicants, however, remarkable control can be achieved, far beyond any earlier experience. These new-type poisons appear to be so remarkably effective because they are slowly volatile. They not only kill as the bait is eaten, but tend to deplete the hordes by contact and fumigant action in addition.

Toxicants of this type which have been successfully used are BHC, Chlordane, and Toxaphene. Prentiss offers concentrates based on all three, in the complete line of Prentox Pest-Tested Insecticide Concentrates.

We suggest that you investigate the potentials for grasshopper, locust and cricket control in your marketing area. Full information on the latest developments is available on request.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y. 9 SO. CLINTON STREET, CHICAGO 6, ILL.

PRENTOX PEST-TESTED CONCENTRATES SOLD TO INSECTICIDE MANUFACTURERS ONLY

DDT CONCENTRATES • SABADILLA DUST CONCENTRATE • PYRETHRUM PRODUCTS • CHLORDANE CONCENTRATES • CUBÉ POWDER

PENCO

BHC PRODUCTS

(Benzene Hexachloride)

HIGH QUALITY TECHNICAL
36% GAMMA CONTENT

To the basic agricultural insecticide manufacturer, Pennsalt now offers technical Benzene Hexachloride.

An improved method is used in the manufacture of Penco Benzene Hexachloride, resulting in a product of high quality and an unusually high gamma content of 36%. The manufacturer and distributor will readily translate these features in terms of *more* warehouse space and *lower* handling costs. Also, this high strength product permits manufacture of dusts and spray bases with preferred qualities for agricultural applications.

PENN SALT

CHEMICALS

In addition to technical grade, Penco Benzene Hexachloride is also available in the following concentrates:

PENCO W-12—A wettable powder containing 12% gamma isomer. An effective micron-sized product especially compounded for spray application.

PENCO D-12—A free-flowing dust base concentrate containing 12% gamma isomer, which makes a highly uniform and lump-free finished dust. This product may be diluted to a finished insecticide in conventional blending equipment.

PENCO SOLVENT CONCENTRATE—An oil concentrate containing 11% gamma isomer, or 1 lb. actual gamma isomer per gallon. Especially suited for manufacture of oil sprays or specialty products.

PENCO EMULSION CONCENTRATE—An emulsion concentrate similar to Solvent Concentrate in composition, 11% gamma, plus emulsifying agents.

Write today for samples and prices.

AGRICULTURAL CHEMICALS DIVISION
PENNSYLVANIA SALT MANUFACTURING COMPANY
1000 WIDENER BUILDING, PHILADELPHIA 7, PA.
TACOMA, WASH. BRYAN, TEXAS

1962